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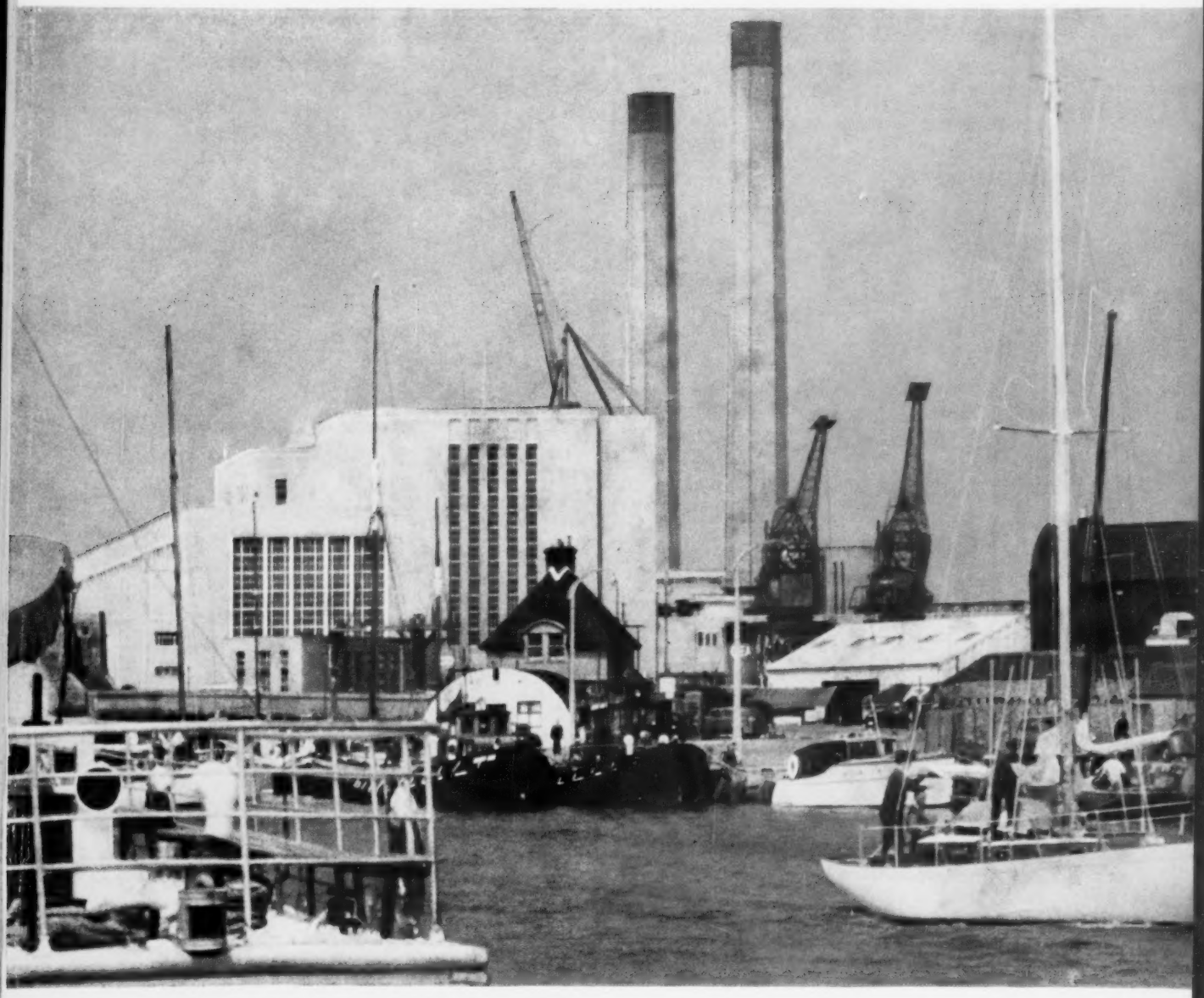

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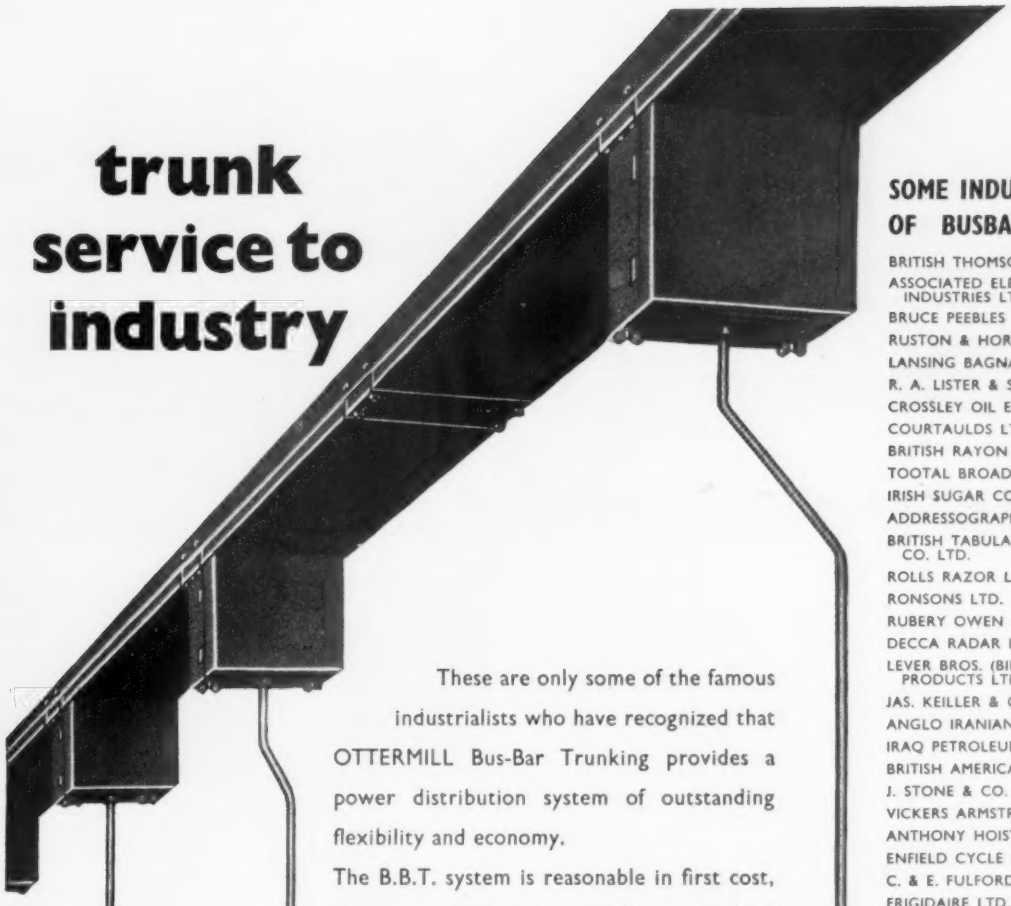

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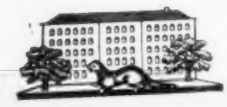

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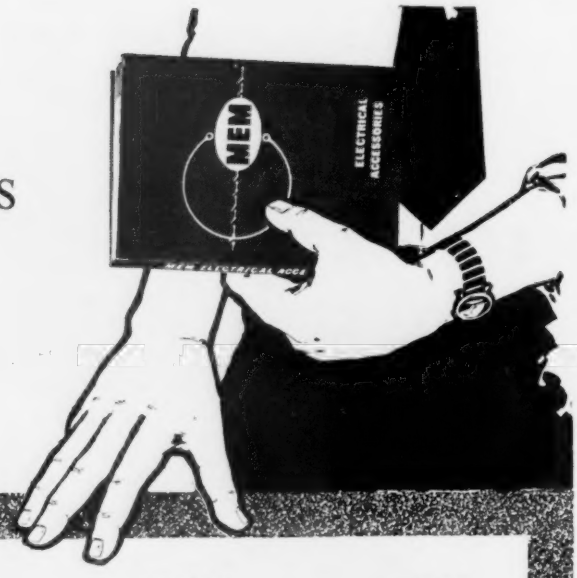

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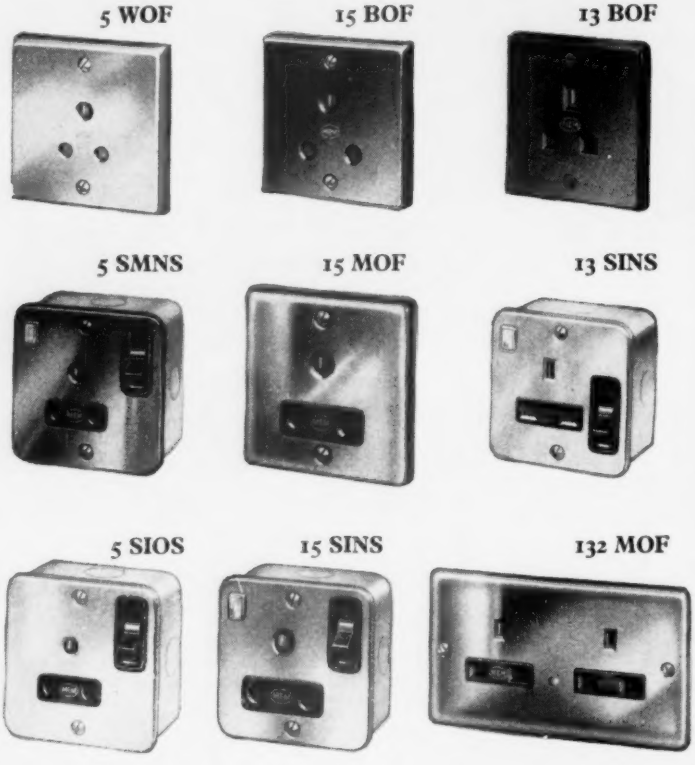

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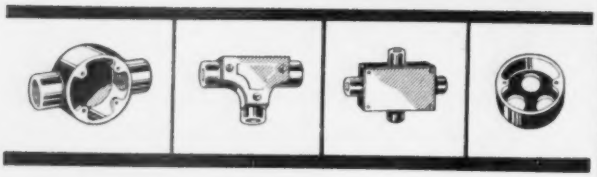

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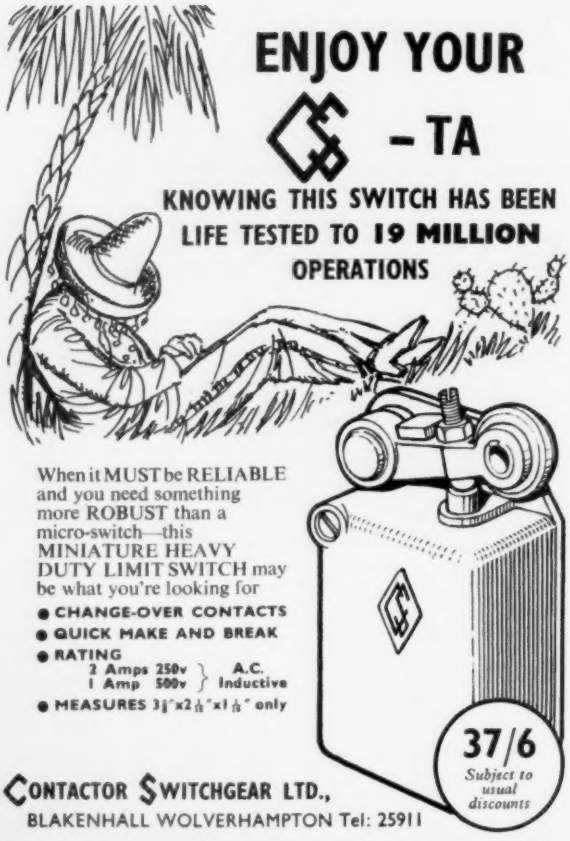

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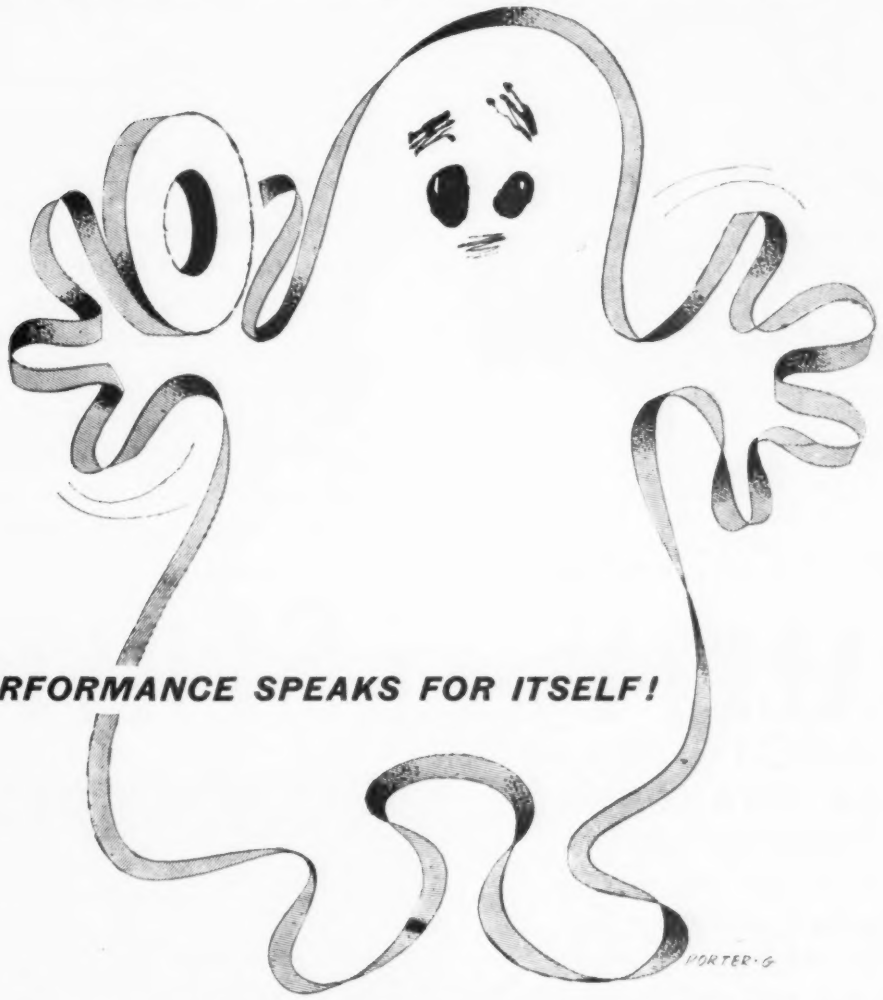

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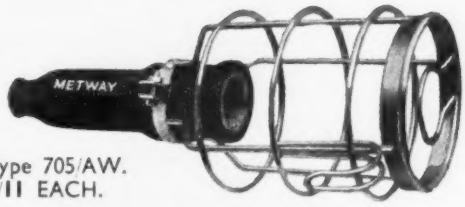

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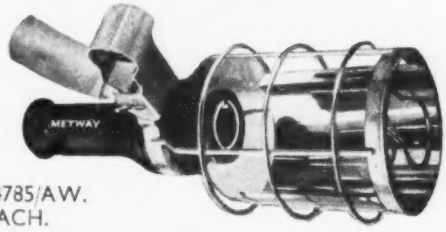

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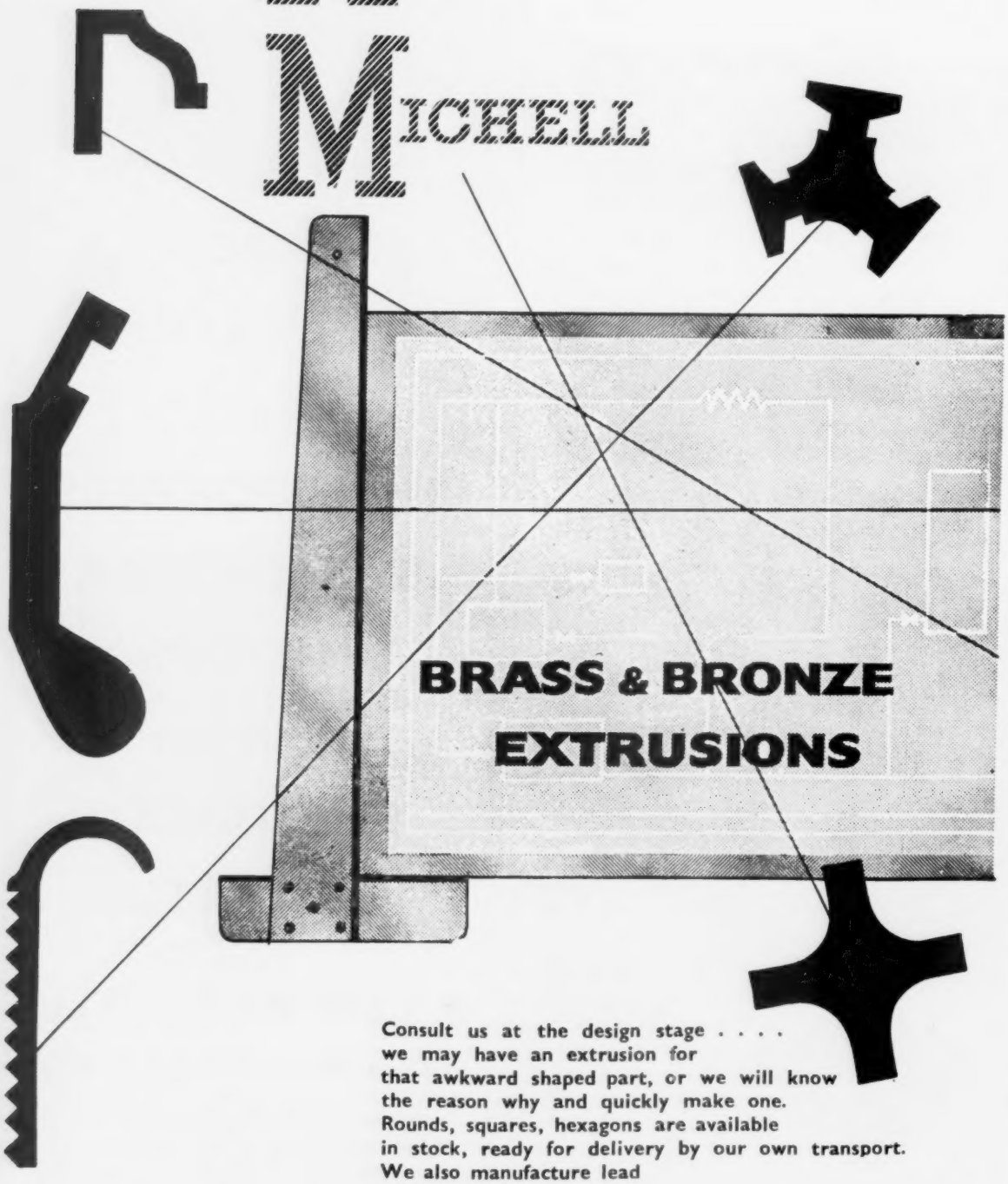

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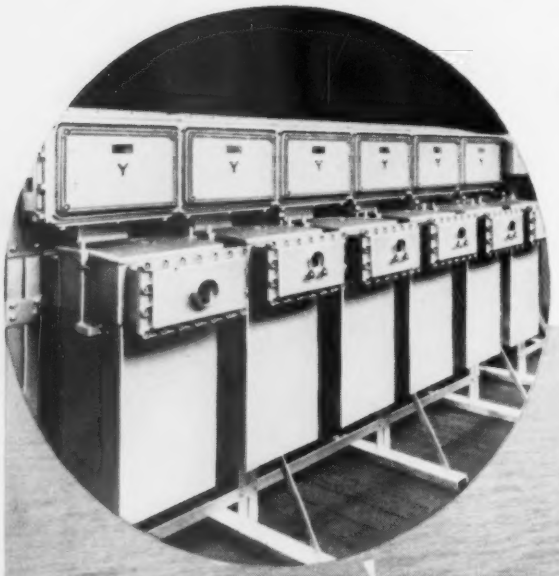

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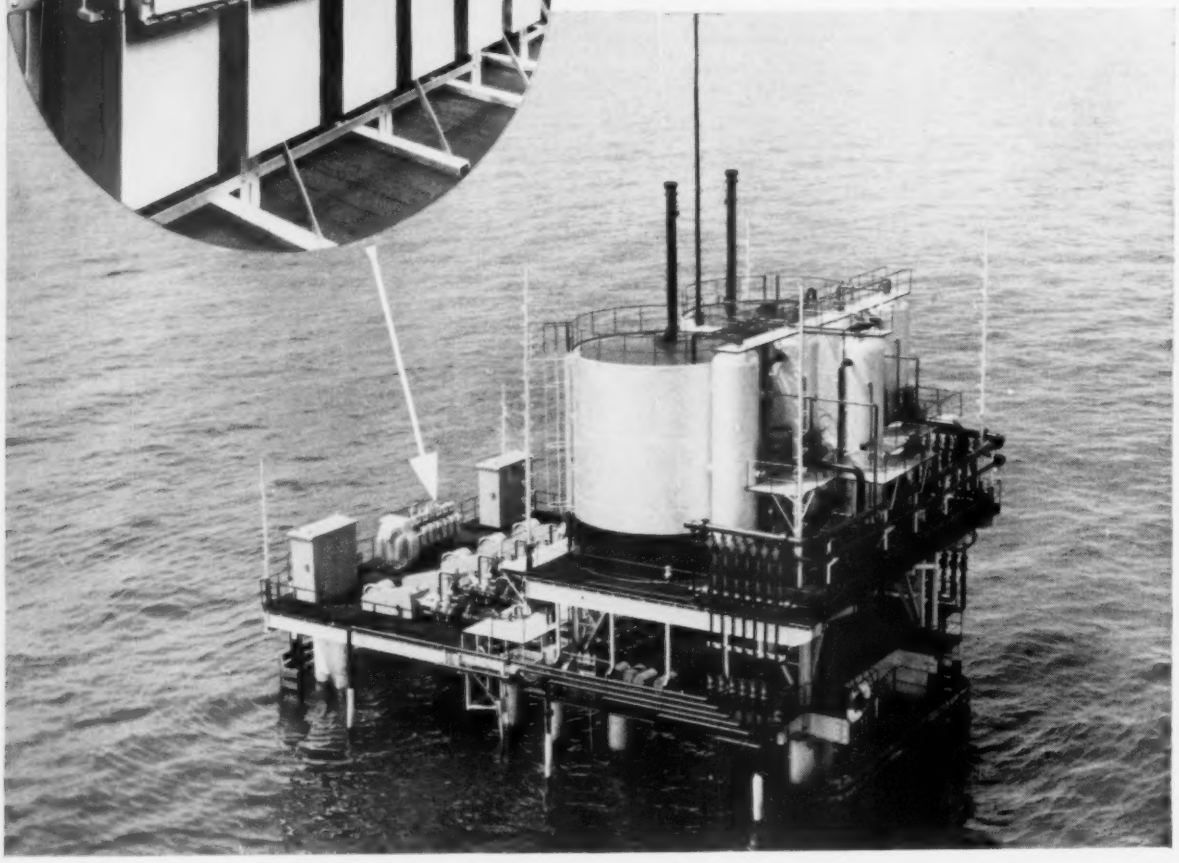

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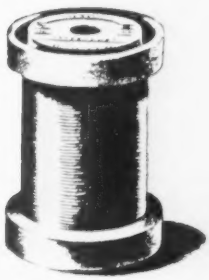

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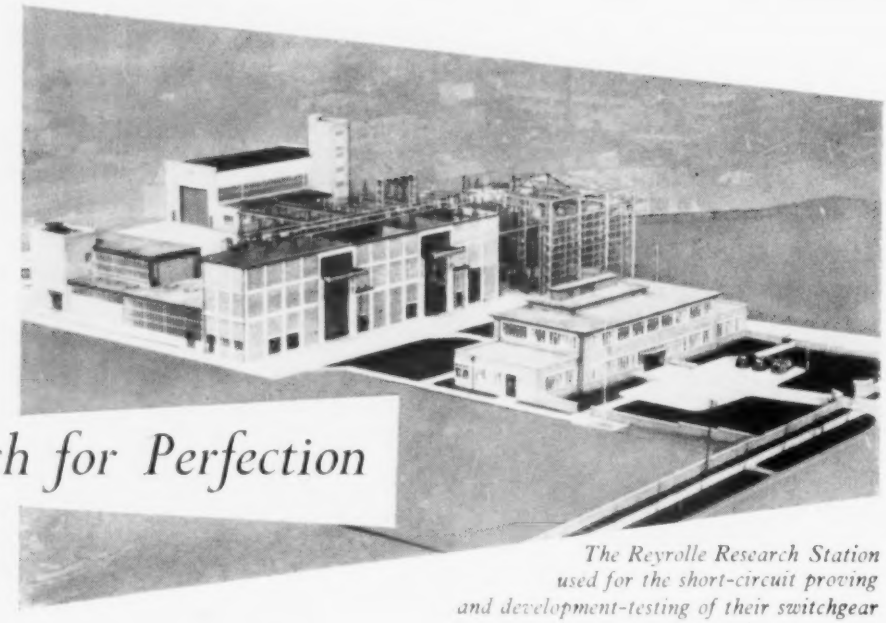

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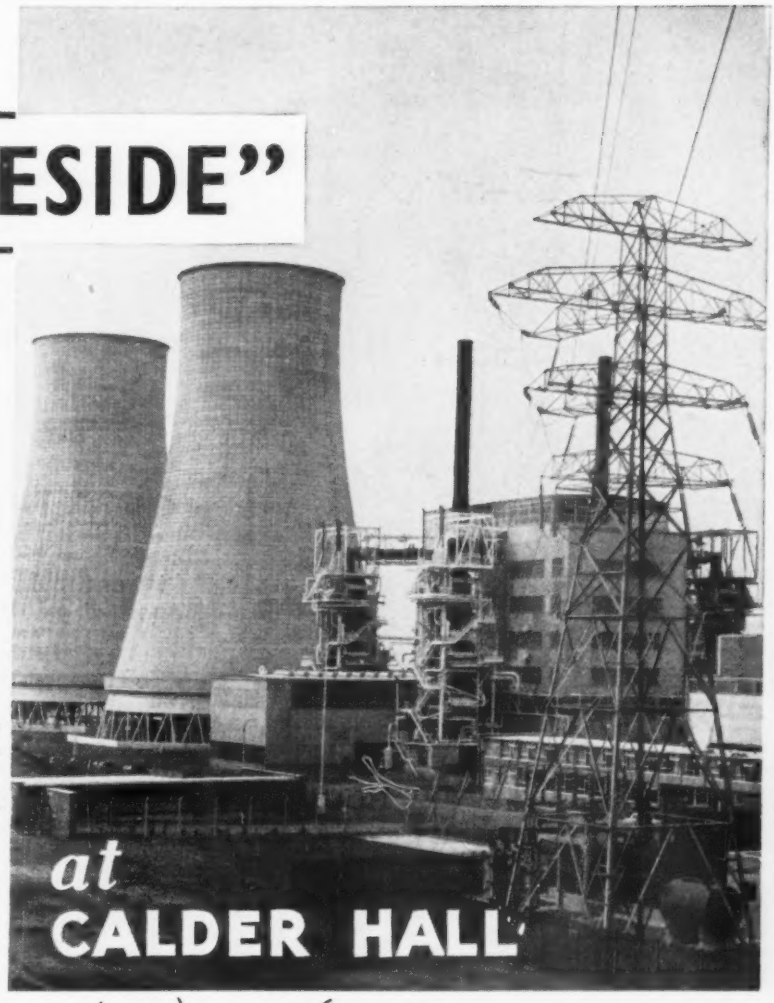

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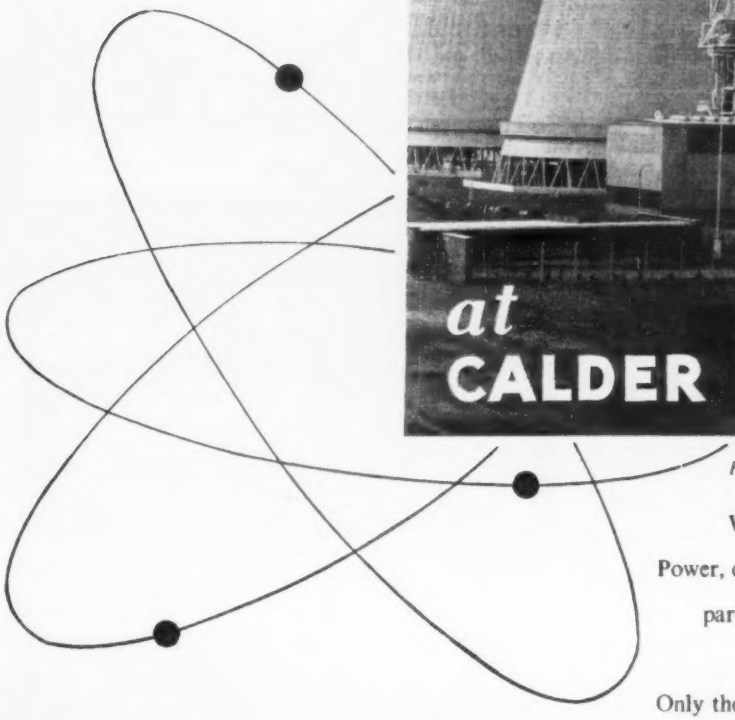

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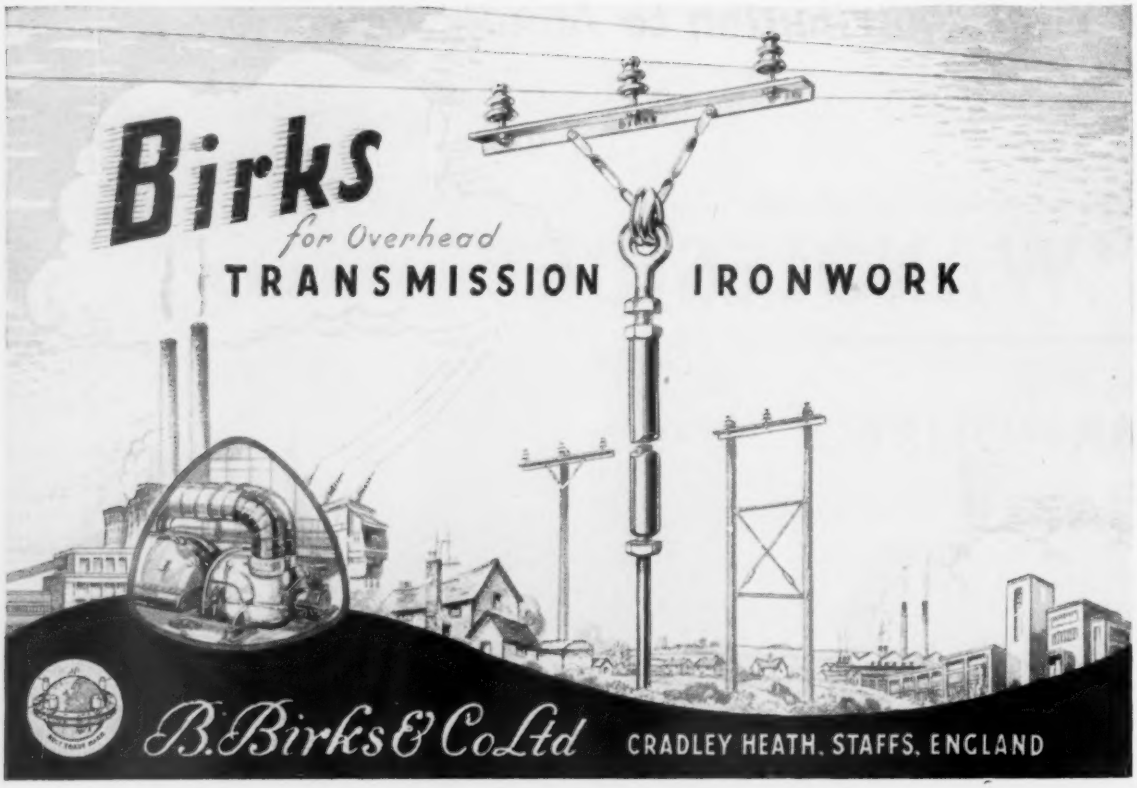

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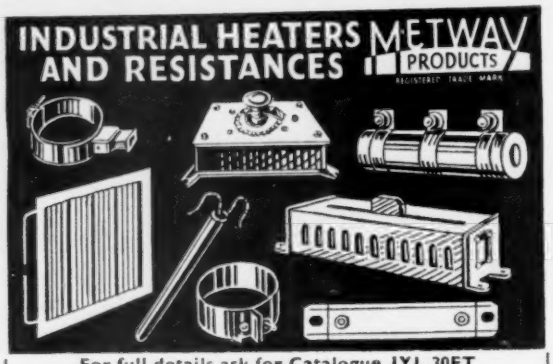

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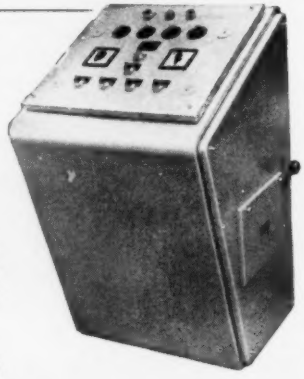

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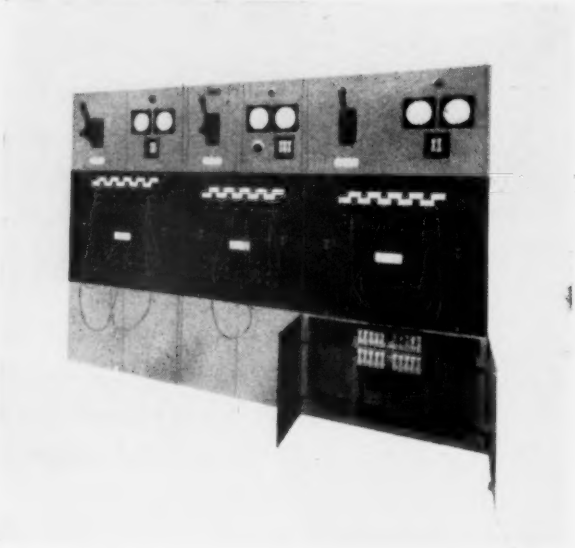

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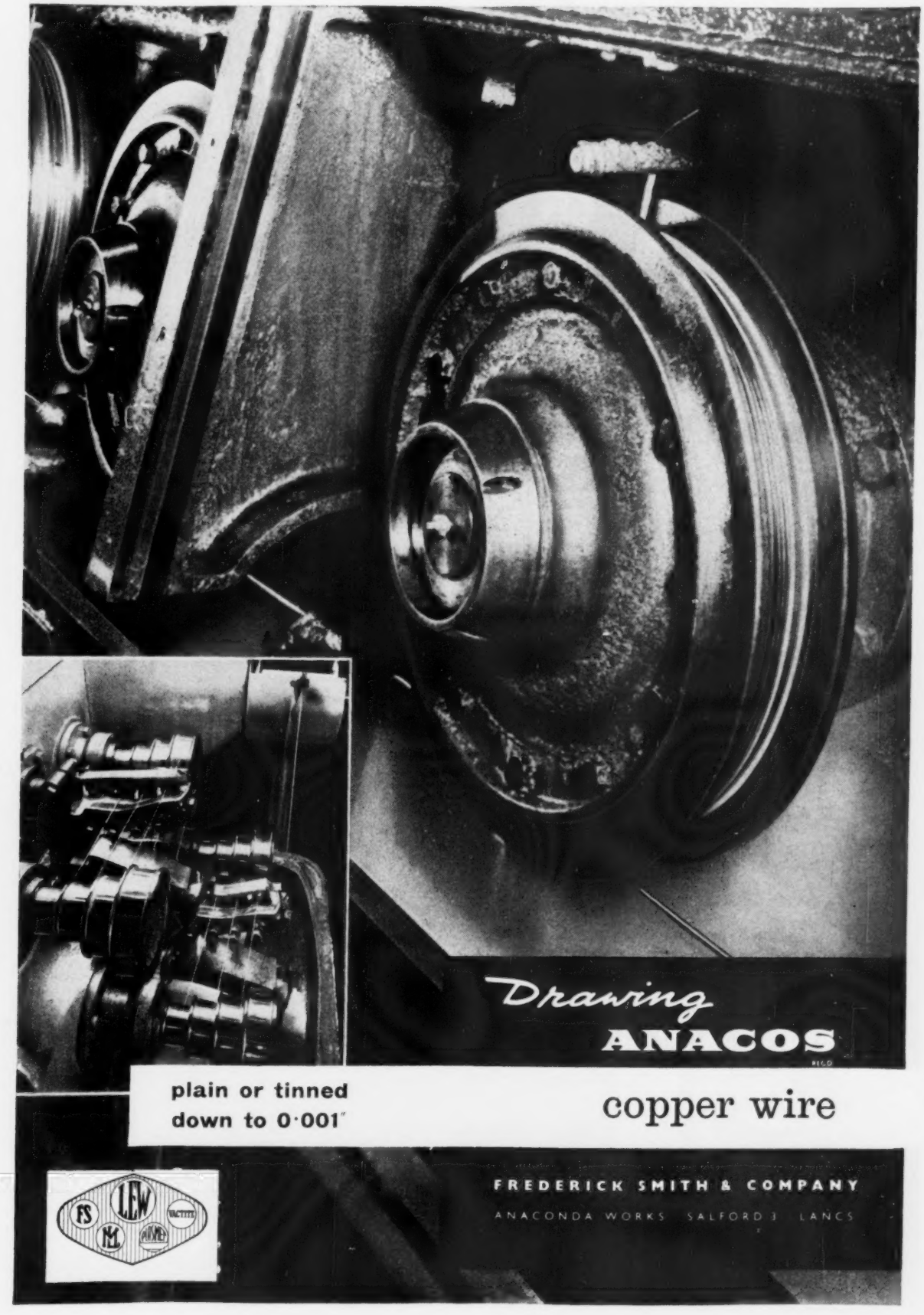
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ANACOS
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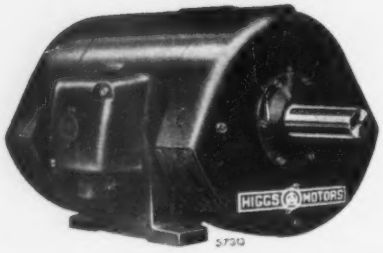

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and

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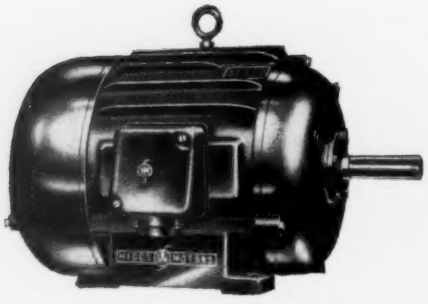

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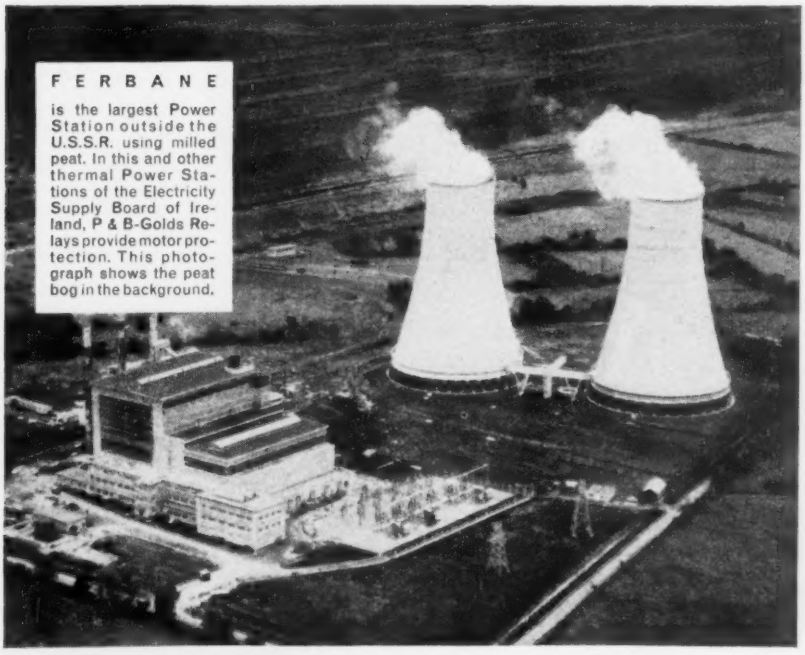

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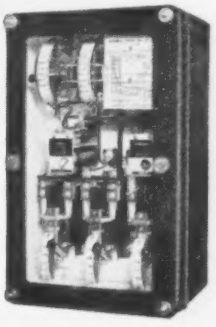

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NEWS SHEET

Statutory powers to prohibit dangerous equipment proposed by Molony Committee in interim report (698) . . . Present position of consumer protection activities examined in report published by Political and Economic Planning. (673, 699)

Battery-driven cars two-thirds cheaper than petrol for "second-car" use, estimates US supply engineer. Operating and capital costs show advantages in ranges up to 50 miles. Semiconductor control, printed circuit motors, offer cheap construction. (673, 678)

Heat pump installation uses diesel exhaust as heat source for building heating. Temperature maintained by control system and by varying number of cylinders used in constant-speed compressor. (686)

"Dead man's handle" for washing machines with electrically-powered wringers recommended by surgeon, following accidents to children causing severe friction burns necessitating skin grafts. (701)

Major international refrigeration exhibition in 1962, venue London, featuring British and foreign products, is plan of British Refrigeration Association. (698)

360 MW of new plant commissioned by CEGB in March. Units sold increases 22·4% to 9,389m., with 610m. and 171m. units sent out by SSEB and NSHEB, respectively. (674, 693)

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Electric light fittings imports jump 60% to nearly £1m. last year compared with 1958. Exports rose 5% to over £3½m. (698)

PEOPLE—I. A. Ferguson becomes manager, AEI heavy plant division's large electrical machine sales, and J Cannell, asst. manager, with N. R. D. Gurney concentrating on metal industries . . . H. H. Mullens to succeed F. W. Gardner (retiring) as chairman, C. A. Parsons . . . V. W. Press leaving Lancashire Dynamo Nevelin to join Limit Engineering as sales director . . . M. H. Beattie becomes asst. sales manager (power cables) BICC . . . C. W. Oatley to be Professor of Electrical Engineering, Cambridge University . . . C. H. Offord appointed director, Honeywell Controls . . . D. C. Lorkin relinquishes LDC managing directorship. (690, 692)

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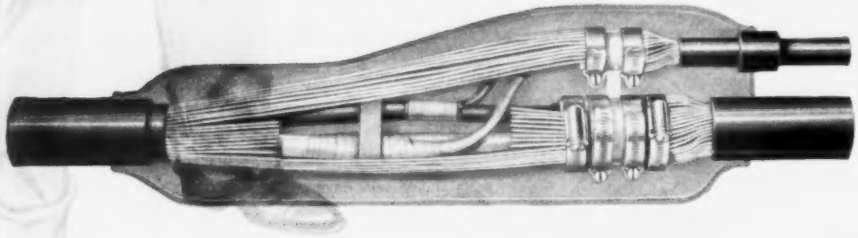

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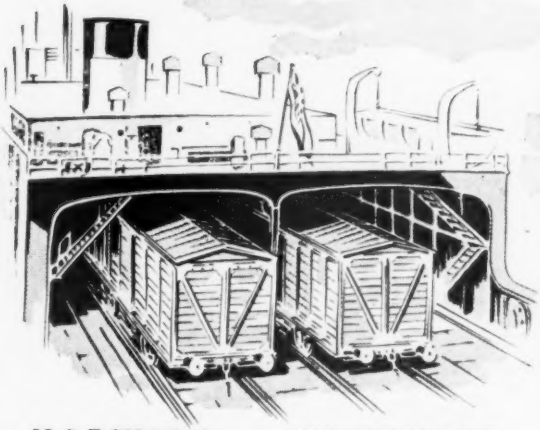

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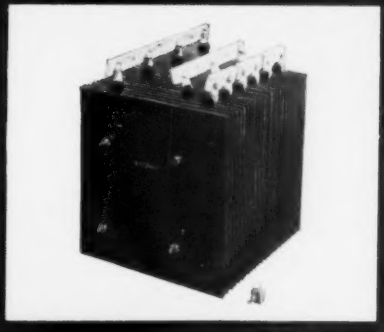

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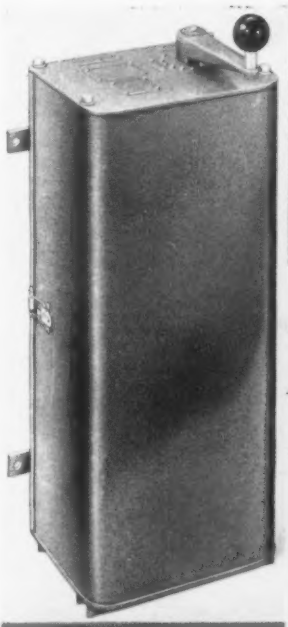

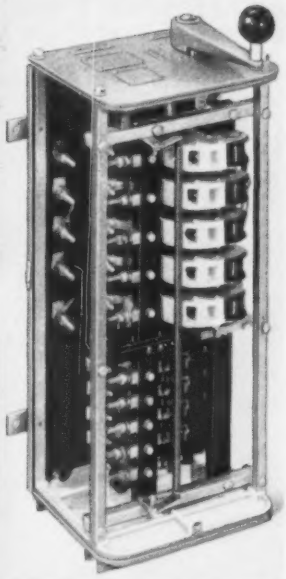

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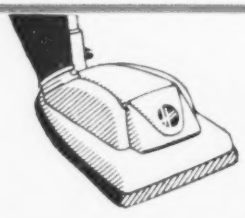

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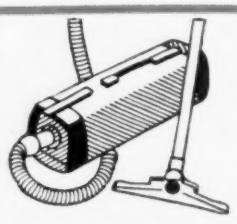

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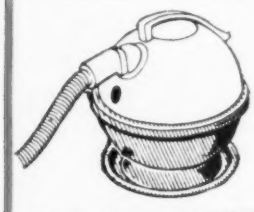
STOCK...DISPLAY...DEMONSTRATE, and you'll PROFIT WITH *HOOVER* this Spring



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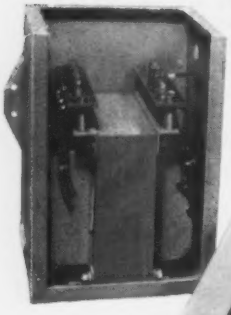

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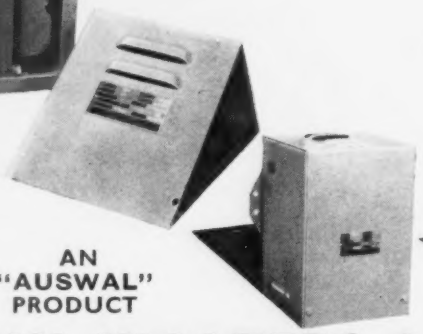

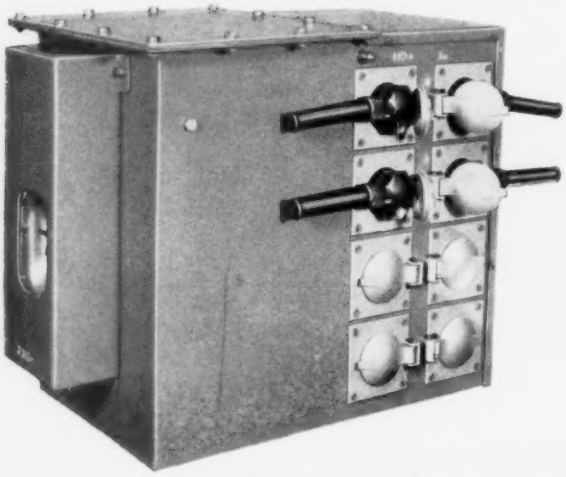

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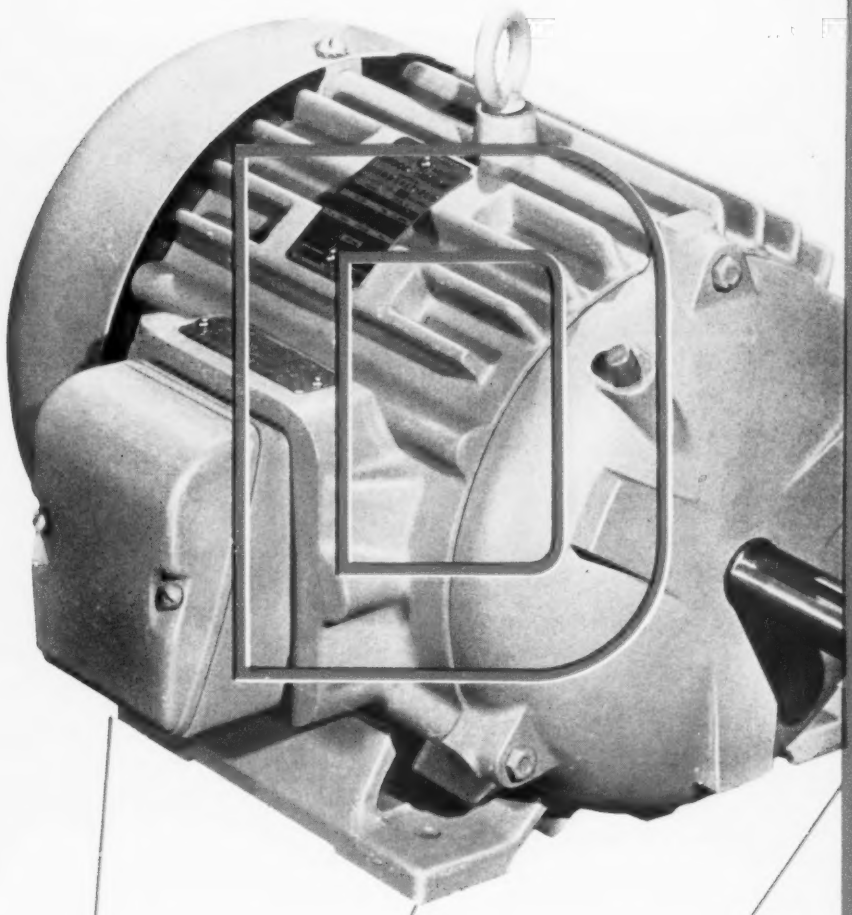

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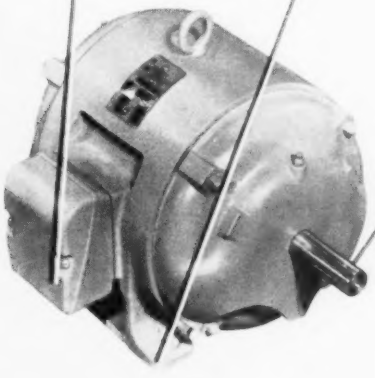

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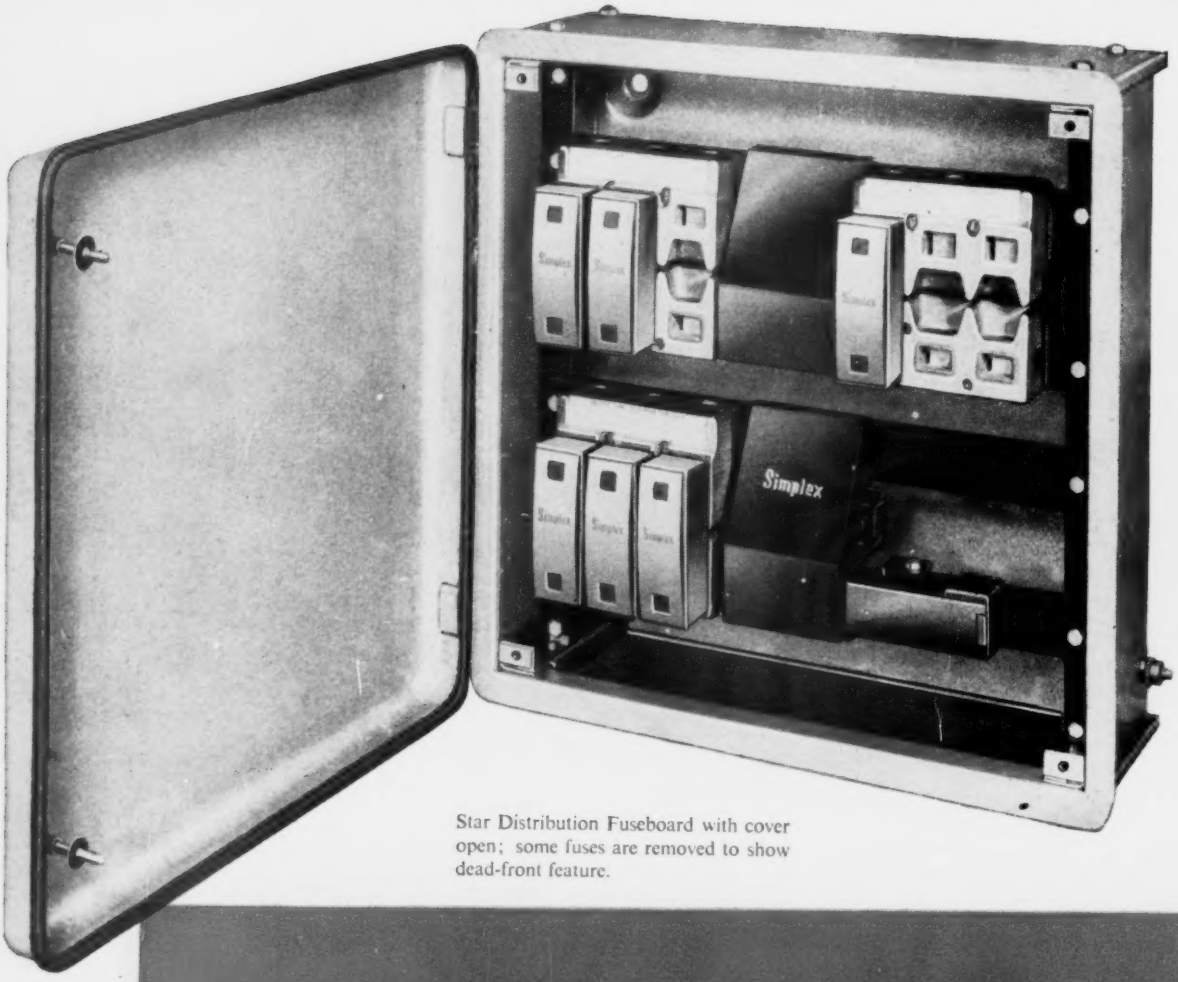
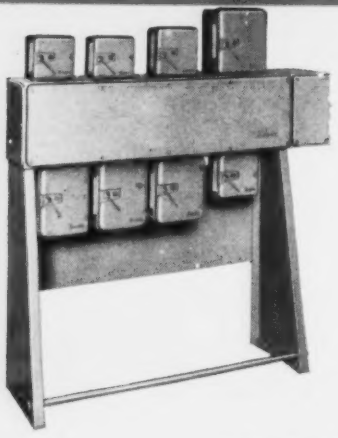


Star Distribution Fuseboard with cover open; some fuses are removed to show dead-front feature.

Simplex



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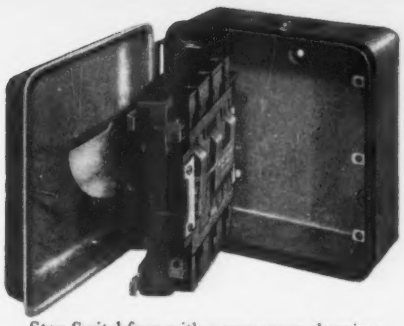
Star



Star Switchfuse with cover open showing interior hinged forward for ease of wiring. Range: AC 500 volt, 15, 30, 60 amp. DC 250 volt, 10, 20, 30 amp.

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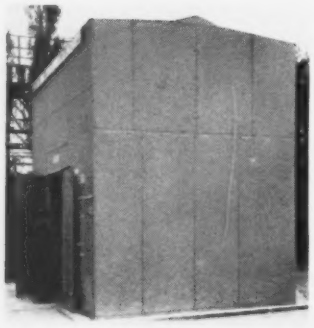
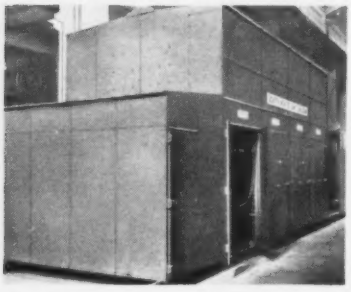
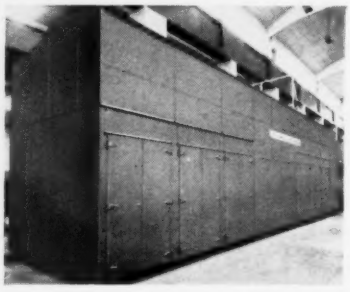


Eastern Electricity Board



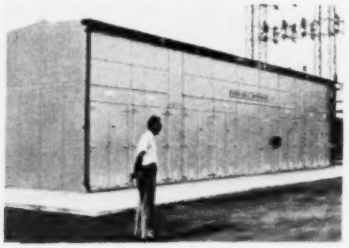
Hong Kong



Union of Soviet Socialist Republics

Southern Electricity Board

North Western Electricity Board



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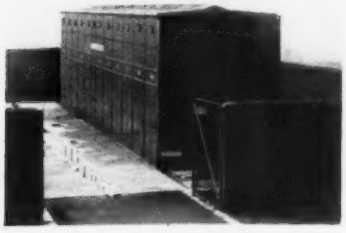
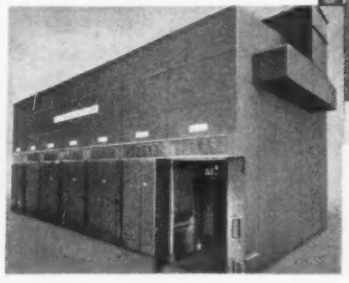


East Midlands Electricity Board



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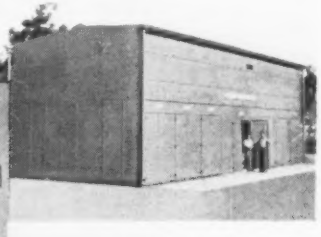

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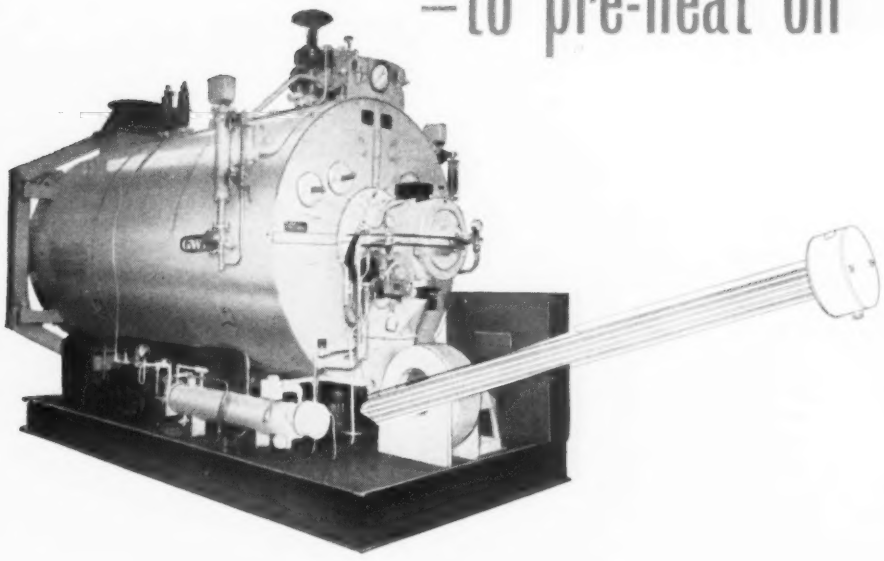

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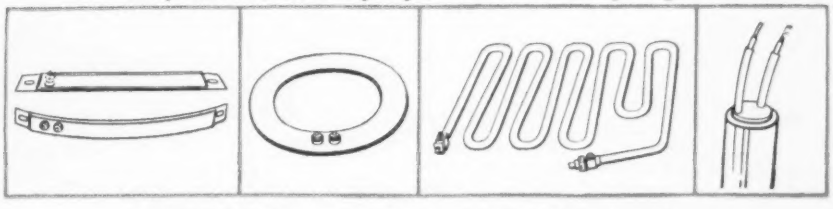

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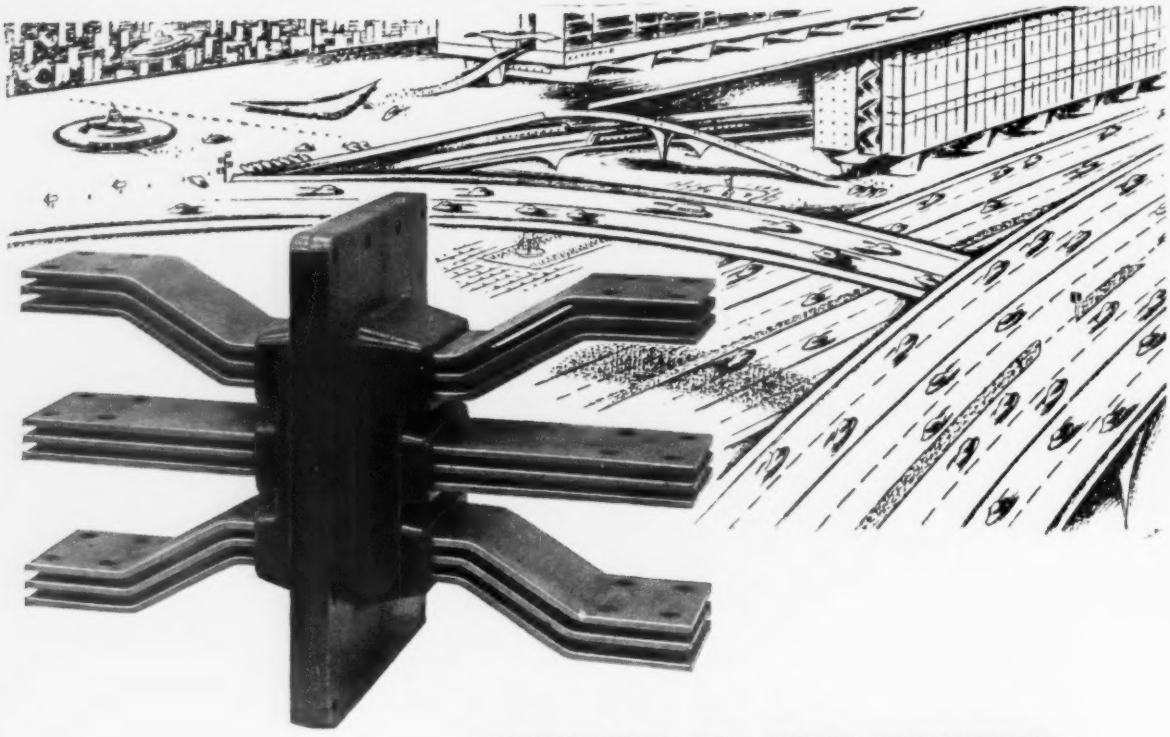

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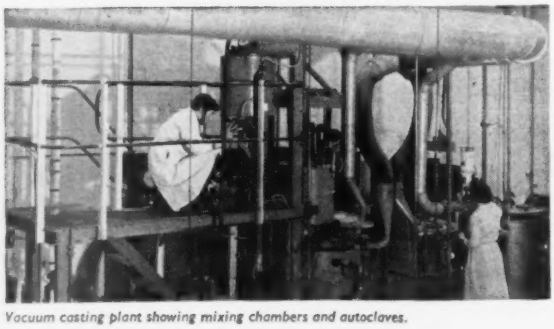

Vacuum casting plant showing mixing chambers and autoclaves.

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THURSDAY 28 APRIL, 1960
Registered as a Newspaper Volume 137 No. 17

ELECTRICAL TIMES

SARDINIA HOUSE, SARDINIA STREET, LONDON, W.C.2
Telegrams: Equivolt . Estrand Telephone: HOLborn 6016

Dans ce numéro

Mesure de la Magnétostriction ... 675
L'importance des effets de magnétostriction dans les tôles d'acier est bien connue. L'article décrit une méthode de mesure des changements dimensionnels dûs à la magnétostriction dans les tôles d'acier électrique, basée sur les changements de capacité d'un montage, dans lequel l'échantillon de tôles constitue une plaque de condensateur. On étudie cette méthode, telle qu'elle est appliquée à des spécimens d'acier au silicium (4%) avec des valeurs différentes de perte d'énergie sous magnétisation par courant alternatif; et l'on compare les résultats obtenus avec des échantillons attaqués à l'acide pour la dimension des cristaux. On établit une relation entre les pertes d'énergie et la dimension des cristaux.

Energie Electrique pour Automobiles 678
Lorsque l'on a besoin d'un véhicule de petite taille et nécessitant peu de frais, pour déplacements locaux, les véhicules à accumulateurs électriques s'imposent par leur économie. Une étude américaine montre que les frais courants totaux s'élèvent à 2,8 cents au kilomètre pour ces véhicules, alors qu'ils atteignent 4.5 cents au kilomètre pour un véhicule équivalent à essence.

Disjoncteurs à Réenclanchement Automatique ... 681
Une grande proportion des fautes qui se produisent sur les lignes de transmission aériennes sont transitoires ou peuvent se corriger automatiquement. On peut minimiser les interruptions d'alimentation, en utilisant des disjoncteurs à réenclanchement automatique, autonomes ou commandés par un relais temporisé. Le "temps mort" doit être bref pour empêcher les moteurs asynchrones du circuit de stopper assez longtemps pour que se produise la désionisation du parcours défecteux; de plus, il faut prévoir des dispositifs de mise hors circuit après le second réenclanchement en cas de fautes prolongées.

In dieser Nummer

Magnetostriktionsmessung 675
Bekanntlich bilden die in Stahllamellen auftretenden Magnetostriktionseffekte eine wesentliche Geräuschquelle. Eine Methode zur Messung magnetostriktiver Massänderungen in Stahlblechen wird beschrieben, die auf Messung der Kapazitätsunterschiede eines Aufbaus beruht, bei dem das Prüfblech eine Kondensatorlamelle bildet. Beschrieben wird die Anwendung dieser Methode auf zwei aus 4%-igem Silizium-Stahl hergestellten Blechstücke, deren Engergieverluste unter Wechselstrommagnetisierung verschiedene Werte aufweisen, wobei die Ergebnisse mit Hilfe von Kontrollstücken geprüft werden, die zur Kenntlichmachung des Kristallgebildes geätzt wurden. Eine Beziehung zwischen Energieverlust und Kristallgrösse wird aufgestellt.

Elektro-Fahrzeugantrieb 678
Bei Kleinfahrzeugen für kurze Strecken und den örtlichen Verkehr stellt sich der Akkugespeister Elektroantrieb als durchaus wirtschaftlich vertretbar heraus. Eine in den Vereinigten Staaten angestellte Untersuchung ergab eine Gesamtbetriebskostenziffer für diese Antriebsart in der Höhe von ca. 2.8 Cents/km gegenüber 4.5 Cents/km für einen äquivalenten Benzinmotorantrieb.

Rückführ-Abschaltautomaten in Energieleitungen ... 681
In Kraftnetzen entstehende Freileitungsstörungen sind häufig vorübergehender Natur bzw. selbstbeseitigend. Versorgungsunterbreschungen können daher auf ein Mindestmass beschränkt werden durch den Einbau selbsttätiger oder durch Zeitrelais betätigter Rückführ-Abschaltautomaten. Die dabei auftretende "tote Zeit" darf nicht so lang bemessen sein, dass sich etwa angeschlossene Asynchronmotore abstellen, muss aber andererseits lang genug sein um die Entionisierung der gestörten Strecke zu ermöglichen: überdies muss eine auf wiederholte Auslösung ansprechende Sperrvorrichtung eingebaut werden, damit Dauerstörungen erkenntlich gemacht und behoben werden können.

Magnetostriction in Steel 675
by J. D. Whitaker, A.M.I.E.E.

Electric Power for Motor-cars 678

U.S. Ideas on Lightning Performance 680

Auto-reclosing Techniques 681
by A. Salzmann, DIPL.ING., A.M.I.E.E.

Heat Pump Recovers Test Losses 686

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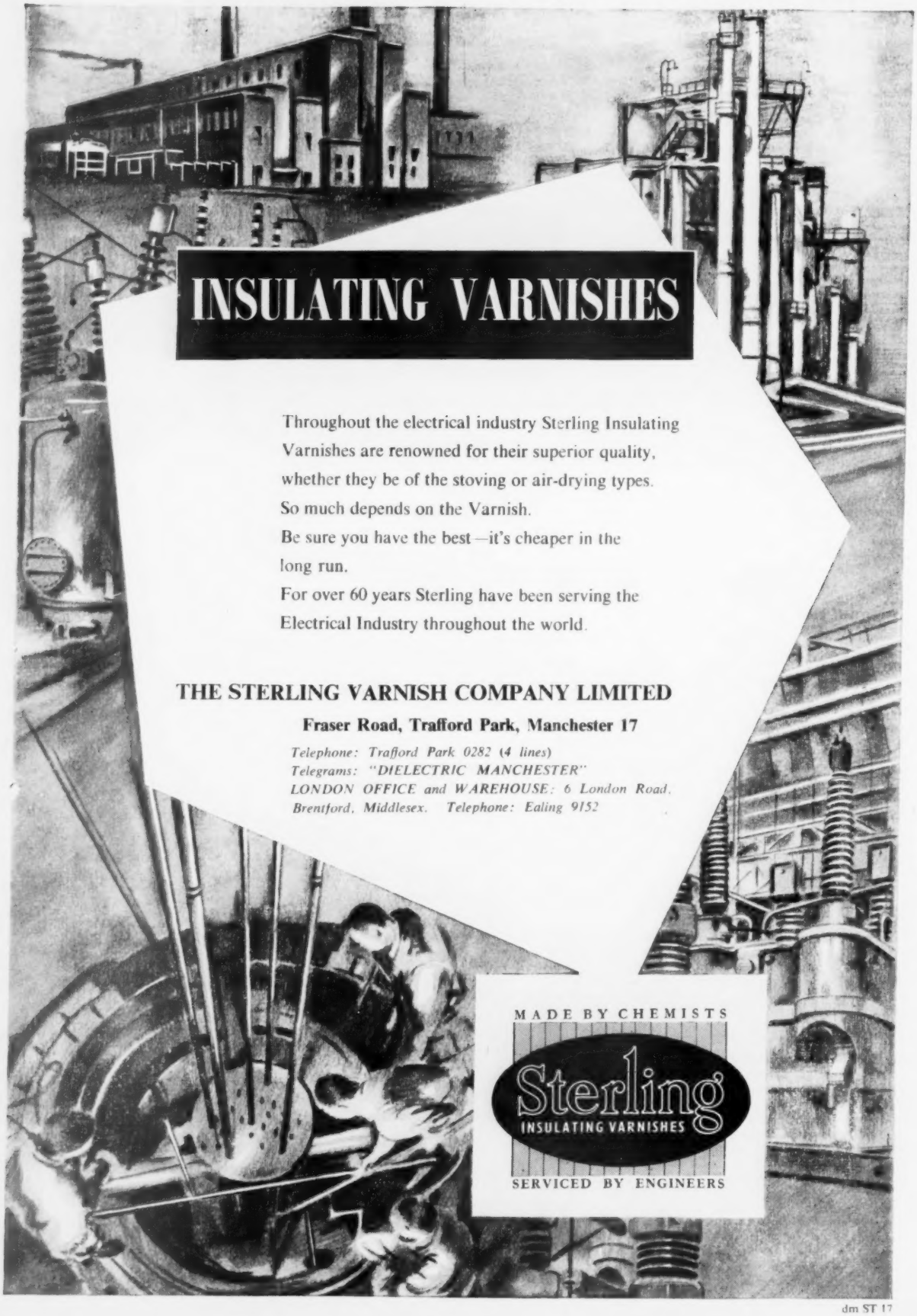

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ELECTRICAL TIMES

ESTABLISHED 1891

THURSDAY, 28 APRIL, 1960

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News Editor:
T. W. WRIGHT

Comment

BATTERY CARS WITH A FUTURE

America has been giving increasing attention recently to the possibilities of electrically powered motor-cars, which seem a particularly attractive proposition as local runabouts. In that application, speed and range are of secondary importance; and since the increasing numbers of American families owning a second car has passed the 20% of all car owners mark, the implied specialisation may be justified. A US paper which we summarise this week looks at the prospects for the battery electric car in the light of current costs, and suggests that all-in cost per mile can be as low as two-thirds of that for a petrol-engined car, even on the basis of present technology. There is difficulty about such price comparisons, since they depend markedly on the amount of use presumed to be made of the car; this follows, since the battery has to be assumed a consumable item. Perhaps the least encouraging feature of the present survey is that the author sees no immediate prospect of a radical improvement in battery performance. So far as circuitry is concerned, he has hopes of solid-state gated diodes to conserve energy otherwise lost in resistive speed regulation, and of the printed circuit motor to give a lighter drive and make regenerative braking easier of application; but the break-through in battery design that could transfer marginal attractiveness into economic compulsion seems still remote. The better prospect may well be the fuel cell, which could fit in well with the concept of an electric-motored car, but which would not give the battery-charging load which makes all battery-electric vehicle development attractive to supply undertakings.

MORE FOR THE CONSUMER

A report published this week by Political and Economic Planning adds to the growing momentum for more "protection" for the consumer by critically reviewing current practice and immediate prospects in that field. Like so many of this organisation's reports, it is a thoughtful survey, with the emphasis on the need to help customers generally make their own buying decisions, based on what the report calls "reliable and honest" information. In this respect it shows the common and understandable bias against seal-of-approval and testing schemes in which manufacturers have an interest. It seems that here PEP, like other critics, ignores an ever-present difficulty in establishing standards of performance as well as safety: the effect on price. Manufacturers know as no other interest can, the complex interplay of factors involved. At present, failure to recognise this leads to contradiction between arguments for helping the consumer advanced from different

groups. The call implied in the present report for fairly high minimum standards of performance and safety cannot more than partially align with the approach adopted elsewhere, that such standards should not be rigidly applied; that the consumer should be allowed to buy a poorer quality at a lower price if he wishes. The interim reports just issued by the Molony Committee will awaken debate again on points such as this.

ROSY LOOK FOR BOARD'S ACCOUNTS

The electricity supply statistics for March, which we summarise on a later page, complete the figures for another financial year; and a bumper one they promise, it will appear, when September brings the annual reports. Despite relatively kindly weather, the sales of electricity for 1959-60 exceed those for 1958-59 by 10·3%, more than in any year since 1954-55. The official estimate of the effect of weather and other factors on sales suggests that given an average year the increase would have been still greater, 11·0%, the largest since this sort of corrected computation became available with figures for the year 1950-51. With all the area boards having recorded a surplus on their net revenue accounts for 1958-59, prospects must be bright for a satisfactory balance again for the year 1959-60. The high figures, of course, reflect in part reaction from rather low industrial growth during 1958-59; and they help to keep expansion of sales at a level which puts the "double in ten years" rule of thumb in the accurate estimate class. A minor milestone in electrical progress in this country will, in fact, be passed in the coming year if the pace is sustained; more than 100,000 million units sold for the first time by the CEGB to the English and Welsh area boards.

THE RIGHT TO GOOD LIGHTING

Evidence of the British Lighting Council to the Government's inquiry into housing standards concentrates on two essentials, as our summary last week showed. One is a claim that the provision of facilities for good electric lighting should be made as much a right of the citizen as that of good sanitation or hot water facilities; the other, that the decorative function of lighting should be recognised explicitly. In practice, both these considerations affect architects and builders in the same way. They can be satisfied only if sufficiently numerous lighting points are allowed when the electrical installation of a dwelling is designed. Even in the present fight for more-adequate electrical installations, there is a tendency to give less attention to the requirements of the lighting installation than to those of the general socket-outlet provision. Justification for this approach is offered along the lines that safety is directly involved if too few socket-outlets are provided. True though that is, it is equally true that safety is affected if too little provision is made for adequate lighting; falls in the home figure large in casualty figures, and the effects of poor illumination are often to be seen in them. As running costs of electric lighting fall ever-lower, the case is strengthened for providing the means of taking advantage of this amenity to the full; but, as BLC recognises, it is unlikely that such provision will be made in the absence of official encouragement, or even sanction.

CABLE CONFIDENCE

Lord Chandos's chairman's speech to last week's a.g.m. of Associated Electrical Industries provides a panoramic view of the future prospects of electrical manufacturing. In one respect, at least, it looks back as well. It gives the large manufacturer's reply to the angled criticisms of the smaller firms about cable pricing policy, and gives it with a balance that merits close consideration. Once price cutting became standard policy on bread and butter lines of cables, Lord Chandos argues that the CMA firms had no realistic alternative but to follow prices down. Selling below cost brought a cold douche of realistic reconsideration to the industry, and the price leadership of BICC in the recent upward move of prices is specifically recognised in the speech, and approved as "self-discipline." Lord Chandos gives a further answer to his critics with a confident prediction that the AEI cable business will do better than break even in 1960, and will move into substantial profit-making in 1961.

RAIN OVER THE HORIZON

The artificial making of rain has a long tradition of the supernatural, hardly viable in the present scientfic age, and the seeding of super-cooled clouds to this end has all the simplicity of the explanation of how a conjuring trick works. Activity in this field has been going on all over the world since the end of the war, but the long-period tests in the Snowy Mountains area of Australia are the first for which a claim of infallibility has been made. Rain making is usually associated with the needs of agriculture but the site chosen for these tests has emphasised its significance to hydro-electric potential. It is necessary first to catch your cloud before it can be seeded with silver iodide. This offers little hope in a large area of cloudless plain, it is likely to be the more successful in hilly and mountainous country, areas which are equally suitable for hydro storage. The ability to increase rainfall in the basins of hydro-electric schemes offers important economic advantages, not so much from any over-all increase in water flow but in the upward rating of firm capacity so that the amount of thermal reserve to cater for a drought year can be reduced. While one hardly thinks of artificial rain making as applicable to these islands, Scotland has had its droughts, with serious effects on the Hydro Board's finances. However, any suggestion of employing artificial methods of increasing rainfall is almost certain to bring its crop of protests from amenity lovers and interests concerned with the tourist trade.

Meteor

This week's quick summary of electrical news faces advertisement page 20.

Magnetostriction in steel

MEASUREMENT METHODS FOR ELECTRICAL SHEET

by J. D. Whitaker, A.M.I.E.E.*

MAGNETOSTRICTION of electrical steel is a phenomenon well known to engineers. The effect of change in physical dimension of certain ferromagnetic materials when subjected to a magnetic field has been utilised for certain types of mechanical transducers[1] and in special electronic oscillatory circuits. However, in inductive equipment, and in particularly transformers, the magnetostriction effect is highly undesirable, not only because of the physical vibrations, but also from noise considerations. Because of the increase in domestic electrical demand, higher-rated transformers are being situated in the load centre of residential areas and the question of noise level and its reduction has become of greater importance.

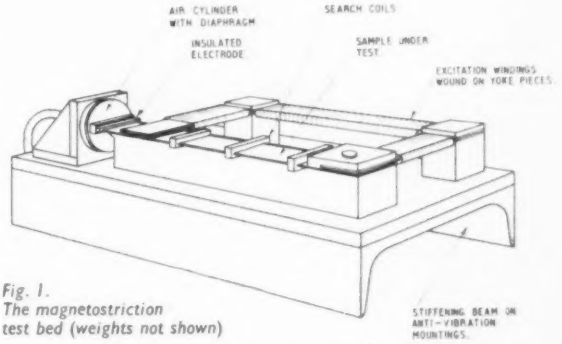


Fig. 1.
The magnetostriction test bed (weights not shown)

Introduction

The two main basic causes of noise in transformer cores arise from magnetostriction and the vibration caused by magnetic flux transfer from lamination to lamination. The flux transfer vibrations can be reduced to some extent by careful design of the core but, even with continuously wound cores, flux transfer will still exist because of the non-uniformity of present-day materials. The magnetostriction effect is found in certain ferromagnetic materials and comprehensive studies have been carried out on single crystals of silicon iron by Webster[2] and also by Honda and Mashiyama.[3] Measurements of magnetostriction in selected grades of electrical sheet steel have been made by Brailsford and Martindale[4] and also by Neurath[5]. The latter found that a steel of 6% silicon had almost zero magnetostriction effects and also other desirable properties but was too brittle for normal handling.

Most of the core material used by transformer manufacturers is of the 3% silicon content and, for materials having uniform properties, magnetisation of single laminations should produce a uniform length extension equal to the sum of the individual crystal movements. For non-uniform material, however, magnetisation could produce writhing and twisting of the lamination as a differential crystal extension would result over the whole area. In view of the highly complex noise variation occurring along the length of a transformer core leg, which seems to indicate non-uniformity of core material, the following experimental work was carried out to acquire data on magnetostriction variation over large sheets of the various grades of electrical steel.

* The author is with the Transformer Department of Messrs Ferranti Ltd.

Test Equipment

The main features required in the magnetostriction measurement equipment were high accuracy and stability combined with ease and rapidity of testing. After assessing the various mechanical, optical and electrical methods a combined pneumatic and electrical method appeared to be the most suitable for quantity testing and equipment based on a circuit by Alexander[6] was constructed.

A test rectangle was assembled in such a way that the lamination under test (an Epstein sample) could rest on a flat polished insulated bed with one end firmly clamped. Three wound yokes, each of four times the cross-sectional area of the sample, completed the magnetic circuit, as shown in Fig. 1. The free end of the sample slightly overhung to within 0·0005 in. of

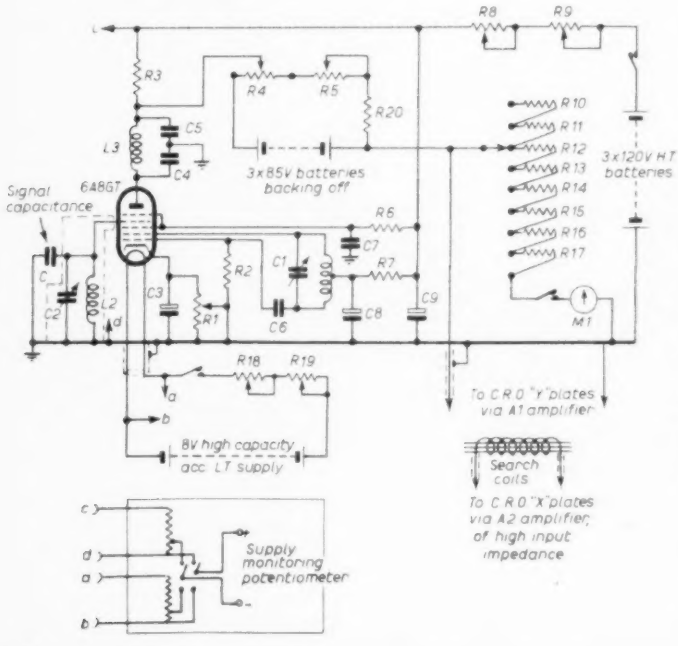


Fig. 2. Line diagram of the connections for an electronic ultramicrometer

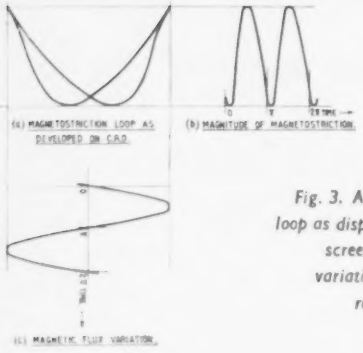


Fig. 3. A typical magnetostriction loop as displayed on an oscilloscope screen and its derivatives, the variations in magnetic flux and resultant magnetostrictive dimensional changes

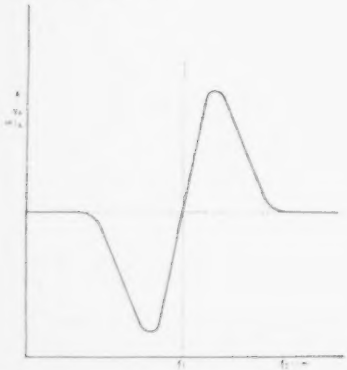


Fig. 4. Graph showing variations of anode current with resonant frequency in the ultramicrometer

an insulated electrode. To prevent any lateral movement of the sample when under test, thin oil was brushed between the sample and the bed and cushioned weights were placed on its top surface.[5] These weights ensured that the film of oil was thin and so produced a large restraining surface tension which effectively restricted lateral movement (tension varying inversely as the cube of the film thickness). The flux density within the lamination was evaluated from the voltages measured in a preformed distributed search coil made integral with the insulated bed. To reduce the load on the search coil and to prevent distortion of the flux-waveshape, the voltage was measured by a high input impedance valve voltmeter. Magnetostriction measurements were confined to the 8 in. length of the sample between the clamp and the yoke.

The Electronic Ultramicrometer

Under 50 cycles excitation, the free end of the test sample lamination oscillates longitudinally at 100 times per second and develops a capacitance change at that frequency between its end and an insulated electrode. This capacitance is connected to the electronic ultramicrometer which consists of an electron-coupled Hartley oscillator using a heptode valve as shown in Fig. 2. The two tuned circuits of the valve are initially tuned to identical frequency (in this case the frequency is required to be in the 10 M/cs range in order to give sufficient sensitivity for the 0·008 pF capacitance change resulting from magnetostriction movement) and consequently the capacitance signal produces a change in operating conditions of the valve. This particular valve has the peculiar characteristic, usually undesirable in a normal coupled frequency-changer, of producing a linear change of anode current for a corresponding change in frequency as shown in Fig. 4. Hence a magnetostriction movement produces a change of capacitance and frequency—which, in turn, produces a variation in the output current of the circuit—and for a constant h.t. voltage this can be detected and displayed on an oscilloscope. Stability of the circuit depends mainly upon the stability of the various applied voltages, provided by heavy duty l.t. and h.t. batteries. As the output signal from the circuit consists of a d.c. voltage of approximately 180 volts modulated by the 0·3 volt signal, the standing voltage has to be completely biased to zero to ensure maximum sensitivity on the oscilloscope. By using a special condenser with micrometer adjustment, a calibration of 0·025 pF per volt output had previously been obtained, giving an equivalent movement of 1 micro-in. for the 0·3 volt signal.

Calibration

To obtain ease of operation and to reduce calibration checking when the equipment was in use, a pneumatic method of measurement was devised. The fixed insulated electrode (forming one plate of the "signal" capacitance) was mounted on the diaphragm of a small air cylinder, such that variations in the air pressure caused deflections of the diaphragm thus altering the position of the electrode, varying the "signal" capacitance, and so causing deflection of the display on the oscilloscope. Using the pneumatic calibrator, the trace on the oscilloscope was deflected a distance equal to the trace peak-to-peak magnitude and the change required in the air pressure gave a direct measure of the magnetostriction.

Air pressure change was read on a water-manometer which, when calibrated to the diaphragm deflection by a special low-reading clock-gauge and extrapolated to zero, gave a sensitivity of 13 mm water gauge per micro-in. By applying to the vertical plates of the oscilloscope the magnetostriction output signal from the ultramicrometer, and to the horizontal plates an integrated voltage derived from the search coils of the test lamination, a direct presentation of the magnetostriction loop was obtained as shown in Fig. 3. Stability of the air pressure supply was obtained by the use of large volume compressed air cylinders and, by using a specially developed micro-needle valve, pressure reading changes of 1 mm water-gauge could be taken thus giving an overall change of length measurement of 10^{-7} in.

Test Conditions

Initial work carried out on the equipment showed that external capacitance of very small value could completely overcome the signal capacitance, so all the electronic equipment had to be very carefully screened and earthed. External vibrations made it necessary to secure the insulated bed to a deep sectioned steel beam and to mount the stiffened equipment on anti-vibration mountings. Although supply voltages to the equipment were constantly monitored, slow drift of the magnetostriction loop occasionally occurred but the measuring technique eliminated any error due to this change. The most critical feature in the measurement of magnetostriction was the placing and positioning of the sample on the bed. Repeatability of test results was obtained only by rigorously observing the same handling and positioning of all samples. The same amount of oil was brushed on to the bed for each sample and the gap between the end of the sample, and the insulated electrode was cleaned from oil and reset with 0·005 in. electrical paper. It was found that the same magnetostriction results were obtained with a sample inverted and reversed and that a sample unclamped at one end gave a reduction of 40% to 60% of the initial total magnetostriction result.

The unit lamination chosen for the series of tests was the Epstein sample of 3 cm by 28 cm dimension. This was done in order that the sample lamination could also be tested for iron loss and permeability in existing testing equipment. Lengths of core steel were cut into marked

Epstein samples such that the location of each sample was known. These samples were then annealed under closely controlled conditions in a laboratory annealing furnace which not only gave an excellent anneal, but ensured the perfectly flat stress-free samples that preliminary work had shown to be necessary for accurate magnetostriction measurement.

Discussion of Results

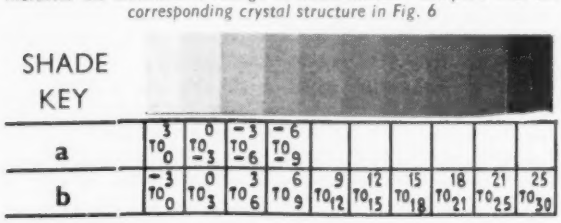
Results of magnetostriction distribution are given for two large laminations of cold-rolled steel having a 3% silicon content. One lamination had a measured watt loss of low value and the other a rather higher watt loss, both at 15 kilo Gauss. Fig. 5(a) shows the variation over a lamination 11 ft long and 1 ft 11 in. wide for the low watt loss material. Fig. 5(b) shows the variation over a lamination 11 ft long and 2 ft 2 in. wide for the higher watt loss material, again both at 15 kilo Gauss. The individual magnetostriction values for all the separate Epstein samples are assembled together as a mosaic. Samples having almost zero magnetostriction are coloured white, samples having a magnetostriction measurement of 30 micro-in. movement over the effective 8 in length of the Epstein sample are coloured black and the intermediate values are shaded accordingly. Values of magnetostriction for the low watt loss material seem to be small and mainly negative and there appears to be only a small variation. The values for the higher watt loss material are, however, larger and mainly positive with only a few small negative values along both edges of the laminations and with greater variation shown throughout. It is believed that, had these sheets been magnetised before cutting, the material with poor uniformity of magnetostriction would have produced a greater range of vibrations and, consequently, twisting and writhing than the more uniform material. In addition, for material having poor uniformity of permeability, a flux differential over the lamination of perhaps 2:1 ratio could occur which, in turn, would produce a greater variation of magnetostriction than that produced with constant flux density.

Examination of acid etched samples of tested material shows some degree of agreement between crystal size and overall magnetostriction distribution. The crystal structure of the low loss material is very uniform and of large size, as shown in Fig. 6a, but the higher loss material generally has a smaller grain size (see Fig. 6b), and there appears to be a definite variation in size across the width of the sheet. Both sheets of steel have a slight variation $\pm\frac{1}{2}\%$ in thickness laterally and a greater variation in thickness longitudinally but there is no evidence of magnetostriction variation with thickness.

The results which are shown have been obtained from a series of tests carried out on several laminations of cold-rolled steel and, although reference to the steel quality has been made, the results are those of the particular lamination examined and are not necessarily representative.

It would seem that, in order to ensure that inductive equipment has low overall magnetostriction, a close control and selection of raw material is indicated. Although the ratio between flux transfer and magnetostriction in the overall noise pattern is not known, it appears that a general increase in the magnetostriction and permeability uniformities in electrical sheet steel could give the opportunity for the design and construction of quieter electrical equipment.

Fig. 5. The pattern of magnetostriction distribution over two laminations, one (a) with a relatively low watt loss and 23 in. wide, the other (b) having a higher watt loss and 26 in. wide. The scale below indicates the dimensional change in micro-inches. Compare with the corresponding crystal structure in Fig. 6



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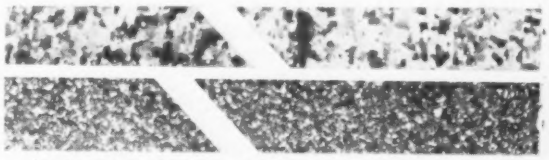
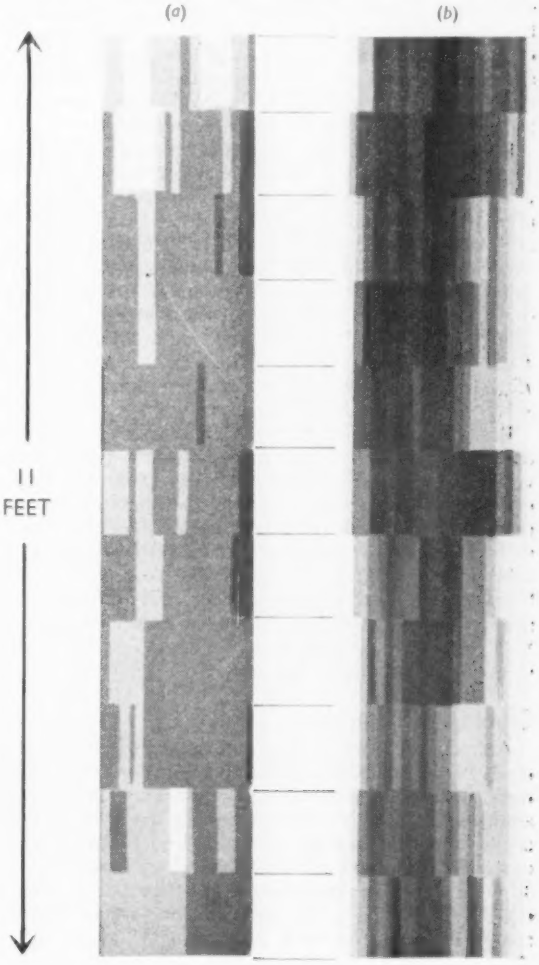


Fig. 6. Etched samples of laminations (a) above and (b) below



Electric power for motor-cars

VEHICLES FOR LOCAL TRAVEL CHEAPER THAN PETROL

ALTHOUGH the electric motor-car is chiefly, at present, of no more than historic interest, the indications are that it will make a comeback in the next decade. This surprising suggestion comes from across the Atlantic and results from the trend for many more families to acquire a second car. This second car is a feature of large urban populations, where a large car suitable for long distance journeys is not economical for short local trips such as daily commuting and social outings. The second car has been acquired to serve these requirements, being essentially a small-size, low cost vehicle.

For such purposes, a battery-electric car has compelling economic and operating advantages over a petrol-engined vehicle, so argues Mr C. R. Erickson in a paper presented last month to the American Power Conference. Mr Erickson is clearly an electric car enthusiast but he is also a supply industry engineer with a small public supply utility—the Board of Water and Light, Lansing, Michigan. He argues that public acceptance of the electric car would result in a significant off-peak load in battery charging. His figures for capital and running costs are, of course, related specifically to the US but they provide useful pointers for ourselves and for other European countries.

In computing the economics of electric cars, Mr Erickson assumes a hypothetical vehicle having a weight of 1,100 lb without batteries, carrying a passenger load of 300 lb and presenting a frontal area of 20 sq ft with an average drag coefficient of 0·27. A battery of 500 lb is taken, with a capacity of 10 Wh/lb at 5 h continuous discharge; the overall electrical efficiency is estimated at 72·5% at 25 m.p.h. Calculations show that 2·84 h.p. will be required to drive the car at 25 m.p.h. on the level, equivalent to 2,120 W. Assuming that the battery discharge is limited to 75% of available capacity, a running time of 1·28 h is achieved, with a range of 32 miles.

Battery costs at 80 cents/lb amount to $400; vehicle costs at $1·20/lb amount to $1,320, thus giving a total vehicle cost of $1,720 (approximately £615). Calculations for other battery weights indicate that although the lowest total cost per mile of range occurs for a 2,000 lb battery, the need to restrict total cost compatible with range indicates that a 1,000 lb battery is the most logical choice. Increase of battery weight does not increase range proportionately; nor, for that matter, maximum speed, and 25-35 m.p.h. would seem to be the desirable range, bearing in mind the purpose of the vehicle.

Operating Expenses

Assuming a 1,000 lb lead-acid battery is employed, the total energy available is about 10 kWh. For recharging, an input of about 120% will be required, or 12 kWh, and assuming an efficiency of 70% for the battery charger, the energy supplied from the mains will be 17 kWh. At 2·25 cents/kWh, the cost of a full charge is, therefore, about 38 cents, which works out at 0·6 to 0·9 cents/mile, depending on speed. The power cost may be further reduced if energy is taken at off-peak rates.

Operating expenses will also include the cost of the battery, as this is an expendable component. A 1,000 lb battery may be expected to last for about 35,000 miles, and at a total cost of $800, this runs out at about 2·3 cents/mile. The total fuel cost will therefore be about three cents/mile and insurance, maintenance and other expenditure will bring this to a total operating cost of 4·5 cents/mile. This compares to an equivalent petrol-engine vehicle operating cost of 7·2 cents/mile; an electric car driven 5,000 miles/year will cost $225 to run as against about $360 for a conventional i.c.e. vehicle. Lower depreciation charges on the more durable electric car will increase this advantage.

Quite apart from economic advantages, the electric car has all the advantages of electric drive over engine drive. Maximum torque is available at starting without the attendant complications of clutch and gearbox. The crucial component of the electric car is, of course, the battery, although the modern lead-acid cell is estimated at having a life of 2,000 discharge cycles.

Modern Developments

Two modern developments may also stimulate electric car acceptance. One is the availability of semi-conductor devices for control of the drive motor. Use of a p-n-p-n gated diode is envisaged, being connected in the motor circuit (the motor being a series-wound machine) together with a series L-C circuit. The operation of the gated diode is controlled by means of a variable-frequency pulse generator (also using a transistor), from which pulses are applied to the gate of the diode to switch it into the conductive state so that current is supplied to the motor. This operation charges the L-C circuit, which automatically discharges a few microseconds later to oppose current flow from the battery, and switch the diode off. Subsequent pulses repeat the cycle. Varying the frequence of the pulses are supplied to the diode gate varies the mean current flow through the diode and thus the power developed by the motor.

The other new development which holds promise of advancing the design of the electric car is the printed-circuit motor. Here the armature consists of a thin rigid disc of insulating material; the armature conductors are of ribbon form etched onto each side of the disc. The disc is positioned between flanges of the motor shaft and rotated in a narrow air gap carrying the magnetic field. Brushes ride directly on the bare surfaces of the armature conductors. If the field is established by wound poles (instead of p.m. poles now used), the motor is given a torque characteristic of a slightly compounded series connected motor which is ideal for motive power use.

Other developments which might also have a bearing on electric cars are fuel cells and solar batteries. Use of the former will have to wait upon the development of lightweight components for both cells and fuel containers. The latter possibility is envisaged as providing additional battery charging energy while the vehicle is parked.

Readers Views

Correspondents writing under pseudonyms are asked to submit their names and addresses in confidence to the Editor

A.C. for Ships

ALTHOUGH Mr Hughes's article (ELECTRICAL TIMES, 7 April) was very interesting, I feel, as a one-time ship's electrician, I must defend the humble d.c. motor.

In my opinion the increased interest shown in a.c. auxiliaries is due, in the main, to the ship owners' desire not to employ electricians. This short sighted policy has existed in some tanker companies for a considerable time now, much to the heartbreak of many second engineers who find the maintenance of the "straightforward" a.c. contactor gear rather demoralising when thrust on top of their normal watch keeping and mechanical maintenance.

For some reason electricians have never been properly accepted at sea, and, as far as I am aware, are still the only ships officers without official recognition in the form of a BoT ticket.

Fortunately, most enlightened cargo-carrying companies carry electricians on their vessels, and the commutator troubles referred to in Mr Hughes's article are extremely rare, providing, of course, that the ship has not had a period of neglect. Ideas such as mutton cloth stretched across motor air intakes provide an excellent filter against the oily vapours of an engine room, and enable a keen electrician to keep commutators, and motor interiors as a whole, in first class condition.

As for squirrel cage motor driven winches, I suggest that the a.c. advocates put their theories to the test in some Far Eastern port where very often all hatches are working day and night loading, for instance, a full cargo of bagged rice. Even with current hold-off coils controlling the rate of acceleration of d.c. winches the load swing on the generators was often alarming and I feel sure that even a diversity of 50% under these conditions would prove inadequate.

R. F. McMurdo,
EDINBURGH 15.

Off-peak Tariffs

YOUR editorial comments on "off-peak" tariffs in your issue of the 14 April appears to be criticism of the effect of the incentive (to consumers) of cheaper rates to create "valley demand".

Whilst I agree that the incentive of cheaper electricity should result in a worth while saving, this should only be available to those consumers who, by the demand they create during possible peaks hours, would affect the boards' demands. Space heating for short periods is only possible for light structures of low thermal capacity, and these are unsuitable for "storage heating".

If the thermal capacity of the building were to be increased by a floor-warming installation sufficiently to enable "off-peak" operation, the increased number of heating hours could result in a higher operating cost than that obtained on a unit charge of, in some instances, twice the "off-peak" rate for shorter hours of heating. I doubt, therefore, that in these instances the incentives of lower operating cost could be given.

The cheaper "last blocks" on the tariffs, appear to be nearly as important as the restricted hour tariffs in the creation of "off-peak" demand and, perhaps, would be more so if this low unit rate was made more noticeable to the consumers with long hours of heating.

From the results of a recent investigation, it appears that direct heating can also create "valley demand". Recording instruments were placed in a library where a low-pressure central heating system had been converted to electric working and it was observed that the mean flow and return temperatures rose steadily during the heating hours each day, for approximately seven hours after switching on. The demand created during the first three hours was the full boiler load of 45 kW and then fell steadily throughout the day to approximately 13 kW. Is an "off-peak" demand of approximately 3½ kW for each 1 kW during peak hours "to be sneezed at"?

An "off-peak" load which creates some peak load may not be the boards' "fairy godmother" but it is not one of the "ugly sisters" either.

Widening of the differential in the tariffs must not prevent natural "off-peak" development.

W. H. Tibbs,
FARNLEY, LEEDS 12.

Fusegear Voltage

IN Mr E. J. Sutton's most interesting article on common installation faults, published in the ELECTRICAL TIMES of 7 April, it is pointed out that single-phase fusegear, connected directly into three-phase, four-wire, busbar trunking, must be rated for the maximum voltage between phases. However, the actual figures given may be subject to misinterpretation, since it is stated that for a 415/240 V supply, the protective gear must be rated for 500 V.

Clearly, it is satisfactory if the gear is rated for 440 V a.c. as is the case with some switchfuse equipment recently marketed for a.c. supplies only.

I believe that the 550 V rating arises from the fact that in the past the majority of switchgear has been suitable for both a.c. and d.c. supplies, and has therefore been rated for 480 V d.c. supplies with centre neutral point.

Recent British Standards, for example BS 3185: 1959, state clearly that switchfuses may be rated for a.c. or d.c. voltages, or both, and it may well be that in the future more and more equipment will be designed for a.c. supplies only.

Incidentally, under BS 88, h.r.c. fuses may be rated for 440 V or 550 V d.c., not for 500 V a.c.

J. S. Smyth,
MANAGER, FUSE GEAR AND ACCESSORIES DIVISION,
THE GENERAL ELECTRIC CO. LTD., W.C.2.

* * *

I AM grateful to Mr Smyth for drawing attention to the new ratings for switchgear contained in BS 3185: 1959. I frankly admit I used the older accepted method of rating switchgear at 500 V, where this applied commonly to a.c. or d.c. systems.

Table 1 in Section 2 of BS 3185 clearly defines the voltage ratings for switchgear and, although some equipment may be rated for 440 V a.c. and 500 V d.c., it

appears that some switchgear may be rated for 440 V a.c. only. This type of equipment would be quite suitable and appropriate for use on the 415/240 supply, and is the type which should be used where the wiring is contained in a common enclosure with that of another phase connected to a system of this voltage.

E. J. Sutton, M.I.E.E.,
Chief Technical Officer, NICEIC,
London W.C.2.

Hum Trouble

THE complaint of noise from a transformer described by Mr Satchwill under the heading "Hum Trouble", 14 April issue, interested me. This noise was, apparently, only troublesome at night, and although this fact constitutes the mystery it is also, I believe, the key to its solution.

During the day, background noise in towns is inevitably much higher than it is at night. Background noise is composed of that made by traffic, aircraft, industry, household appliances, etc., and in fact, most of us, as we go about our daily tasks, contribute to it in some measure. In the case under consideration, the higher level of background noise would mask that made by the transformer, which can at most be only a low level noise. Thus, during the day, although making as much noise as it does at night, the transformer is not noticed. Conversely, during the night, the noise level created by the transformer is higher than the background level which has subsided, consequently the transformer is heard.

K. T. Reed,
Development and Design Dept,
Anderson Construction Co. Ltd., Twickenham, Middx.

* * *

HAVING read with interest Mr Reed's note, I would like to say that the house in question is in an unusually quiet position, standing in its own grounds in a very lightly populated residential area, at about 200ft above sea level. It has thick fitted carpets throughout and, other than the very occasional passing car, daytime noise is practically non-existent. While Mr Reed's suggestion would certainly be applicable to the majority of houses, I do not think in this case is provides the answer.

W. Satchwill,
Eastbourne, Sussex.

U.S. Ideas on Lightning Performance

ONE of the most important problems engaging the attention of transmission engineers at present is that of the unexpectedly high number of lightning faults experienced with lines of the highest voltage. Amongst distinguished engineers who have put forward theories to explain the discrepancy between results and previously accepted calculations are Messrs C. F. Wagner and A. R. Hileman (US Westinghouse Electric Corporation); and these authors develop their ideas in a paper presented to the recent American Power Conference organised by the Illinois Institute of Technology.

Lightning Stroke Characteristics

The standpoint of these two authors is that the previously accepted methods of calculation lack rigour and omit some important factors. They think that more attention should be paid to lightning stroke characteristics, particularly the effect of the electric charge in the stroke channel above the tower. Their argument is that the voltage appearing across an insulator string of a transmission line tower struck by lightning can be resolved into two components. One is that due to the current fed into the system from the stroke; the other is that due to the changing charge in the stroke above the tower.

Much of the paper is concerned with a discussion of the fundamentals of the lightning stroke problem, in terms of the electric fields produced by currents and charges. This gives particular attention to the effect of the electric charge above a transmission line tower. The authors claim to show that the voltage across insulator strings caused by this charge cannot be neglected in the way it is in conventional calculations. Indeed they suggest it is due to this voltage that high outage rates have been experienced on a specific 345 kV line they discuss. The relative importance of the stroke current and the charge above the tower is dependent upon the assumed stroke characteristics. In general, the current effect is the more important for shorter fronts, and the charge above the tower for longer fronts. With the stroke characteristics which the authors have assumed in their work on this problem, the two effects are of equal importance for a stroke current wavefront of two microseconds.

Results

Lightning fault performance on the line mentioned has been 7·2 flashovers/100 miles/year, compared with 0·5 flashovers predicted by the standard method of calculating line performance. Working from the methods proposed in their paper, the authors obtain calculated rates of between 10·9 and 12·4 flashovers for stroke currents with one mircosecond from zero to peak on the wavefront; 8·2 to 9·4 flashovers for two microseconds; and 5·8 to 6·6 flashovers for four microseconds. A ½ microsecond wavefront gives 15·8 to 18·0 flashovers.

The authors note that other investigators of the discrepancy between results in practice and calculations have paid attention to the rate of rise of stroke current rather than charge above the tower, and have mentioned lightning currents of more than 30,000 amps with times to crest as low as ½ microsecond. The authors recognise that data on these points is incomplete, but think that available information points to wavefronts in excess to two to four microseconds.

Stroke Mechanism

Little is known absolutely about the charge above the tower during a lightning stroke. The authors suggest that evidence from measurements of the electric field remote from strokes indicates that steps of the downward leader as it proceeds towards the earth have smaller and smaller variations in current, and shorter time intervals. So while the steps do not disappear completely as the earth is approached, it seems that they may be neglected so far as their effect is concerned, and the downward leader regarded as a charged conductor extending with a constant velocity as it approaches the earth.

Auto-reclosing techniques

APPLICATION TO POWER TRANSMISSION SYSTEMS REVIEWED

by A. Salzmann, Dipl. Ing., A.M.I.E.E.

HIGH speed automatic reclosing circuit-breakers have found increasing application on power transmission systems in recent years. Even for parallel circuits and duplicate supplies, reclosers should not be ruled out since, by their use, standby plant can be reduced, system stability improved and efficient operation achieved with greater economy. On overhead transmission systems the majority of faults are transitory; therefore high speed auto-reclosing of circuit-breakers is desirable. The objects are (1) to secure continuity of supply, (2) reduce damage to equipment, such as the burnout of conductors, damage to insulators, etc., and (3) to prevent the spread of the fault to other phases. In addition, rapid reclosure between interconnected generating stations will ensure system stability and should enable motoring loads to be maintained through the supply interruption.[1] A schematic diagram illustrating the application of auto-reclosers on power transmission lines is shown in Fig. 1.

Successful high speed reclosing is achieved if the circuit-breaker remains open just long enough for the recovery of the dielectric strength of the fault path but not long enough to interrupt operation of the connected load in service. The period required to extinguish the arc (deionisation interval) will depend largely on the type of circuit breaker. For oil circuit-breakers the period of interruption must be longer—by reason of the arc-maintaining properties of the volatilised extinguishing medium—than for air-blast breakers with no mechanical linkages and a deionising air supply derived from an external source.

As an example, for non-resistance switched breakers the deionisation interval for small fault currents is greater than for high MVA short-circuits; consequently the resetting period—that is, the sum of the deionisation interval and the closing time of the breaker, usually controlled by an external time delayed reclosing relay—needs to be increased for low values of fault current because a delayed recovery of the dielectric strength necessitates a prolonged deionisation interval. Too short a "dead-time" (the time between the tripping of the breaker and its ultimate reclosing) may result in an unsuccessful reclosure if it does not allow time for the recovery of the dielectric strength of the fault path, a factor not related to circuit-breaker performance. That is to say, at the instant of re-establishment of the circuit, the voltage may restore the fault.

For successful reclosing on a transient fault the sequence is as follows: *High speed trip—Reclose*. For a persistent fault the sequence is: *High speed trip—Reclose—Delayed trip—Lockout*. The sequence of operations is shown graphically in Fig. 2. In general, a breaker should be considered as high speed if the total break-time (the interval between closing the trip coil circuit and the extinction of the arc between the contacts) is not greater than five cycles throughout the whole range of breaking capacities.

The dead-time must be short, particularly on e.h.t. systems, and certainly less than the time required to maintain stability, which is usually of the order of ten cycles. Dead-time is dependent upon both electrical and mechanical factors and a slow speed protective system response and a large break-time in the circuit-breaker both contribute to a long dead-time.

In the design of conventional oil-circuit-breakers it is important for the operating mechanism, after opening, to attain stability in the shortest possible time, for this is a factor determining the commencement of the reclosing cycle and the two together govern the dead-time. Air-blast breakers, though costly, have no mechanical linkages and so contribute to a very small dead-time. However, it is possible to increase the dead-time where single-phase high-speed auto-reclosures are used on a three-phase system with solidly earthed neutral to guard against earth faults since maintenance of supply on the unaffected phases helps to keep the systems in step and/or maintains motoring loads on a "single phasing" basis over the break period.

Let us now examine the use of auto-reclosers in (a) radial networks, (b) ring mains and meshed networks and (c) interconnected power systems supplied from different generating stations.

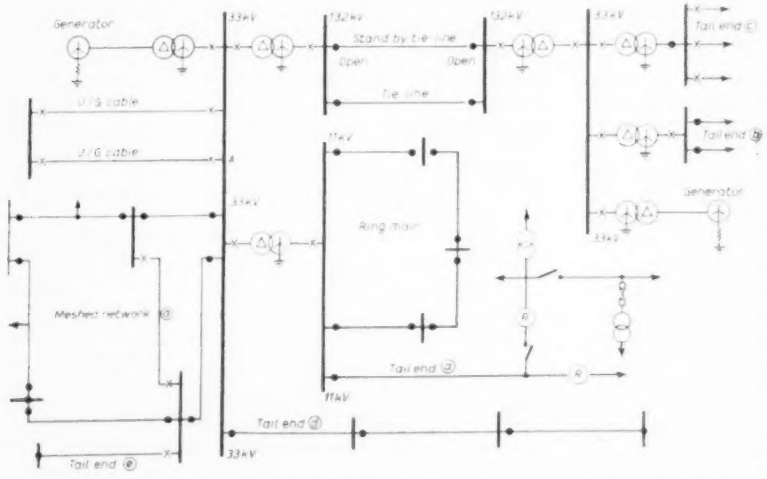


Fig. 1. Schematic diagram of auto-reclosers as applied to various sections of a power transmission system. (a) Tie lines, (b) ring mains, (c) meshed network, (d) tail end feeder, (x) non-auto-recloser, (•) breaker with auto-reclosing facility, (R) pole mounted recloser

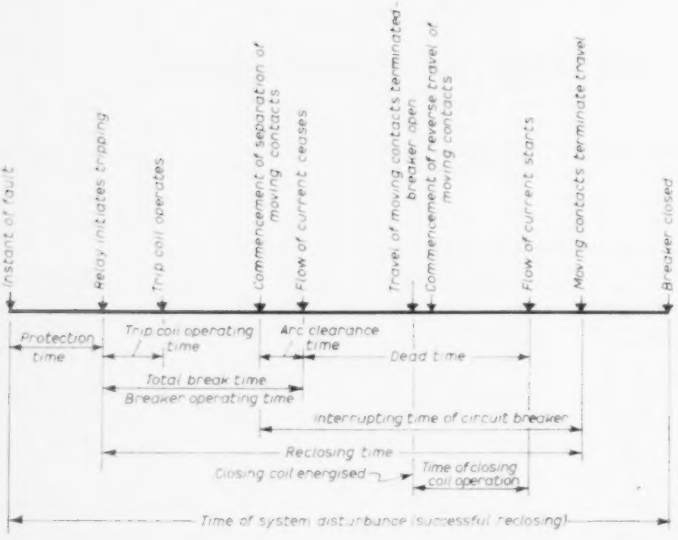


Fig. 2. The basic time-travel diagram for operation of a high-speed auto-reclosing circuit-breaker

Radial Networks[2]

Here we have to distinguish between high speed auto-reclosers, with self contained tripping and reclosing elements whose operation is initiated by series coils, and circuit-breakers with reclosing elements controlled either automatically by gear mechanically coupled to the circuit-breaker mechanism or externally by a reclosing relay through an electrical link. The former are commonly used as pole-mounted units, while the latter are more usually ground based. (Fig. 1).

Pole-mounting reclosers are usually given an operating cycle of two instantaneous openings followed by two-time-delay openings before "locking-out."[3] This form of protection removes transient faults before slower acting fuses have time to rupture and reclose automatically while more persistent faults on spur lines might be cleared before the breaker locks out. Their application is, however, restricted by reason of the limited breaking capacity in the range.

With ground-based non-resistance switched breakers it is an advantage to initiate the reclosing cycle externally by a reclosing relay when interrupting small-fault currents. Here the relay can be adjusted to accord with the fault MVA level. For resistance switched breakers, adjustment of the dead-time in relation to the short-circuit MVA level is not required.[4]

Feeder protection tripping is initiated either by impedance relays or by instantaneous and inverse time over-current relays. With over-current protection the instantaneous relay operates on a transient fault to trip the breaker before a branch fuse blows; the breaker then recloses after an interval determined by the setting of the reclosing relay. If the fault persists, the instantaneous relay circuit is automatically opened after the first trip cycle and the inverse time relay is used to initiate the second trip cycle. Further reclosure is then prevented by the lock-out relay. By this arrangement the second trip is delayed long enough to give branch fuses time to blow so isolating the faulty circuits and reducing the dislocation of supply on the healthy branches to a minimum. Should the breaker not trip within the period set after reclosure, the instantaneous relay circuit is automatically restored to normal operating conditions for any further emergencies.[5]

Ground-based reclosers can be divided into two broad groups; single reclosers in which each feeder is protected by a circuit-breaker with auto-reclosing features and group reclosers in which a number of feeders are protected by a common auto-recloser. The latter is usually applied only to rural distribution networks. The sequence of operations with group reclosers for transient faults is *High Speed trip—Reclose*. For a persistent fault the group recloser then remains closed for a further period before initiating the locking-out operation to allow the protective relay of the faulty feeder to isolate it from the system by tripping its own non-reclosing breaker selectively.

For tail-end feeders supplying several substations connected in cascade and protected by impedance relays, high-speed protection should be applied to the total length of each section. This can be effected by overlap impedance protection. Here the instantaneous zones are extended into the adjacent sections as illustrated by dotted lines in Fig. 3. For a transient fault, breakers (1) and (2) will trip and reclose simultaneously. If the fault is persistent, breaker (2) only will trip again and lock out, while breaker (1) remains closed and maintains supply to substation (B). This is effected at the instant breaker (1) recloses by automatically moving back the instantaneous zone setting of relay (1) to 80% of the feeder length. In this manner the ohmic setting of the impedance relay is modified and the relay under-reaches. A further advantage of overlap impedance protection is that arcing faults along the total length of each section are cleared rapidly.

Summarising, the requirements for successful auto-reclosing on radial networks and tail-end feeders are: (a) for pole-mounted reclosers; self-contained high-speed tripping and reclosing characteristics combined with high-speed circuit clearance; and (b) for ground-based reclosers; a short break-time, to limit damage to equipment and speed-up reclosing, and the minimum of dead-time. This must be related to the period required for operation of the circuit-breaker mechanism (which must attain stability before the reclosing cycle commences) the interval required for full de-ionisation of the fault path and, in addition, the over-all break-time must be short enough to maintain induction motors in service but long enough for the breakers of synchronous motors to trip.

Ring Mains and Mesh-connected Networks

Overhead line ring mains and mesh-connected networks are usually protected by high-speed impedance relays. For high speed auto-reclosing, the breakers at each end of the line section must trip and close simultaneously. In general, since the reach of protection from either end

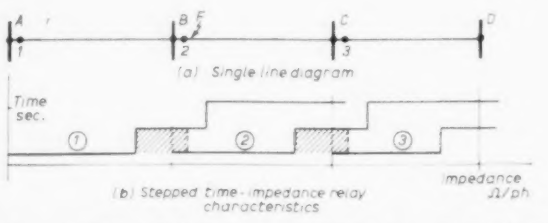


Fig. 3. Overlap impedance protection applied to a tail-end feeder

is about 80% of the feeder length, for some 60% of the whole distance simultaneous tripping is automatically effective.

To provide simultaneous high-speed tripping and reclosing over the *whole* length of the line, the protective reach from either end is extended to 120% of the line length thus ensuring instantaneous and simultaneous operation of both circuit-breakers for a transient fault anywhere in between. In the event of a persistent fault, a second trip on reclosure of the far end breaker is prevented by automatically moving the protective reach back to 80% of the line length.

This is illustrated in Fig. 4. The instantaneous zone of relay (a) is extended into the adjacent feeder, CD, as shown by the dotted line characteristic. A transient fault in section BC at F will be cleared instantaneously by circuit-breakers (a) and (5). Section BC remains in circuit after closure and, if the fault persists, both breakers will again trip and lock out.

For a fault at F_1 circuit-breakers (a), (b) and (4) will trip simultaneously. On reclosure, and assuming that the fault is transient, all three breakers will remain closed. On a persistent fault only two breakers, (b) and (4), will open, leaving (a) closed because, on reclosure, the cut-off value of the instantaneous zone of (a) was moved back to 80% of the line length causing it to under-reach. This was effected by relay contacts modifying the ohmic setting of relay (a) automatically. By this means selective operation was ensured on the second trip.

The basic circuit for switched overlap impedance protection utilising rectifier elements is shown in Fig. 5. Assuming a "red-to-yellow" fault and, for clarity, omitting switching and self-sealing circuits, for a fault within the reach of the first zone (120% line length) starting over-current relay (A) will energise impedance element (Z), directional element (D), and timing unit (TU), to close their contacts Z, D, and, at the same time, to provide a d.c. tripping current via a rectifier. After a lapse of about 0·1 second, contact (TU.1) closes to complete the circuit to tripping relay (E) which, in turn, closes contacts E.1 and E.2 tripping the breaker and energising reclosing unit (RU).

The functions of the reclosing unit RU are as follows[6]:

(a) to reclose the breaker after a short lapse of time sufficient deionisation of the fault path, and

(b) on reclosure, to move back the setting of the instantaneous zone to 80% of the line length by short-circuiting resistance R_s, via contacts RU-1. In this manner selective disconnection of the faulty section is ensured in the event of unsuccessful reclosing.

(c) Subsequent to reclosure, the unit RU is blocked for about ten seconds and, should the fault persist during this period, a second trip with no reclosure will take place and the breaker will be locked-out. If the fault is of transient nature and no second trip occurs, the relay reverts to normal operation after the blocking period has expired.

(d) The last function of the unit is to record the number of trips and reclosures on a counter.

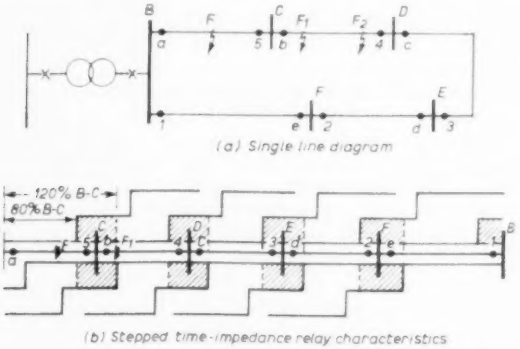


Fig. 4. Overlap impedance protection as applied to a ring main

Example of Relay Setting

Let us now determine a suitable length of time for system disturbance with successful reclosing on feeder CD (Fig. 4) with a fault at F_2. Let us also assume that breakers of identical characteristics are employed and that the reclosing cycle is as shown in Fig. 6.

Applying overlap impedance protection, the time may be determined as follows.

Time (sec.)	Cycle No.	Operation
0	0	Fault occurs.
0·06	3	Near and far relays (b) and (4) operate to energise the trip coils.
0.16	8	Near and far circuit-breakers trip (total break-time, 0·1 sec.).
0·36	18	Near and far circuit-breakers reclose (deionisation interval, 0·2 secs.).

Thus, allowing for a deionisation interval of 0·2 secs. the dead-time (from tripping to re-establishment of supply) is 0·3 sec., the total fault clearing and reclosing period being 0·36 sec. or 18 cycles.

In the event of breakers (b) and (4) not tripping simultaneously, assuming that the fault current flowing through relay (4) is insufficient to operate the starting over-current relay, the faulty section has then to be disconnected at both ends long enough for the recovery of the dielectric strength of the fault path which we have assumed to be 0·2 seconds. Since relay (4) will not respond to the fault current until relay (b) has cleared (a period of 8 cycles or 0·16 secs after the fault has occurred) the deionisation period of 10 cycles allowed before the breaker (b) is reclosed will be shortened by the overlapping interval of 8 cycles while the fault is maintained through (4) giving a total fault deionisation period of only 2 cycles, which is clearly insufficient. After this period the fault will be re-established through (b). It is, therefore, necessary to increase the reclosing time of (b) by an amount equal to the clearing time of (4), that is, 8 cycles, to give a total reclosing time of 18 cycles or 0.36 secs. To cater for the case where (4) opens before (b), the reclosing cycle of this, too, must be extended by a similar amount (Fig. 7).

This is assuming that both breakers have similar

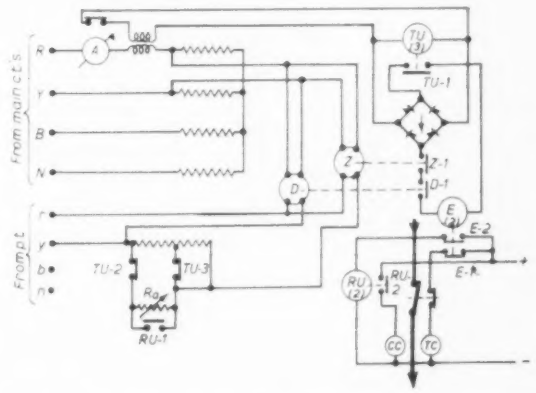


Fig. 5. The basic circuit for overlap impedance protection. (RU) reclosing coil; (CC) closing coil; (TC) trip coil

characteristics, but similar conditions will arise for breakers having dissimilar characteristics as shown in Fig. 8. For simultaneous tripping the dead-time of breaker (4) has to be increased from 0·2 seconds (10 cycles) to 0·36 —(0·06+0·1)+0·1, or 0·3 secs. to permit a minimum dead time for breaker (b).

When applying plain impedance protection, and assuming that 80% of each section is protected by the high-speed breakers with a time delay of 0·5 sec. in the second zone for relay (4), we again have to lengthen the reclosing time of breaker (4) by 0·5 sec for reasons as in Fig. 7.

It should be noticed that, in conditions ruling in Fig. 1, the section supplied via feeder (a), having no tapped-off loads, does not require auto-reclosing features since no consumers are involved and voltage regulation is not affected, but overlap impedance protection with high-speed fault clearance should be applied laong the total length of each section to deal with arcing faults.

Interconnected Power Systems [7, 8]

There are two forms of interconnected networks which we have to consider; in the first there is the case of a factory supply system derived from its own generating plant operating in parallel with the mains supply and, in the second, the case of two or more power systems deriving their supply from different major power stations operating in parallel.

Dealing with the first, production stoppages in large factories through supply failures can be avoided by the use of private generating plant with capacity sufficient to maintain priority loads over the period of disturbance. Let us consider the case of such a plant in a factory power station with duplicate busbars as shown in Fig. 9 and interconnected with a public supply system. The factory alternators are connected to the busbars feeding the priority industrial load, limited to the rated output of the alternators, and the incoming mains supply is connected to the busbars feeding the non-priority loads, both busbars being interconnected by a bus-coupler for parallel operation.

In the event of a fault occurring on the public supply system the alternators and priority loads must be isolated from the non-priority loads and, at the same time, voltage and frequency must be maintained regardless of the system disturbance. This can be effected by the provision of sectionalising protection comprising (a) an under-voltage relay supplemented by a frequency drop protective device for persistent faults and (b) an under-voltage relay supplemented by a protective device which will respond instantaneously to large frequency changes to deal with direct power failures. For (a) we shall assume that the load consists mainly of induction motors equipped with circuit-breakers having time-lag, under-voltage tripping to prevent disconnection in the event of a large momentary voltage drop during the period of disturbance. The additional protection provided by (b) ensures high-speed operation of the bus-coupler and prevents a drop in speed of motors driving priority loads.

In general, high-speed auto-reclosing is applied to the incoming feeder. On the occurrence ot a fault the line breaker and non-priority load remain disconnected for the period of the dead time and the high-speed sectionalising protection trips the bus-coupler. There is no need to automatically reclose the latter because the alternators are capable of supporting the priority loads while the non-priority loads are restored almost instantaneously if auto-reclosing of the line circuit-breaker is successful. All that happens is that the paralleling of the two systems is dispensed with until reinstatement by manual operation.

By an alternative method a fault on the incoming feeder is made to trip the line breaker and reclose at high speed only, leaving sectionalising protection to trip the bus-coupler only if the phase displacement between the two systems drifts beyond a permissible value over the period of dead time.

In the case of interconnected systems deriving supply from different major generating stations, it is well known that system stability imposes a limit on transmission capacity of the intervening networks. Obviously it must be desirable to avoid instability even under the most

Fig. 6. Auto-reclosing cycle of a circuit-breaker

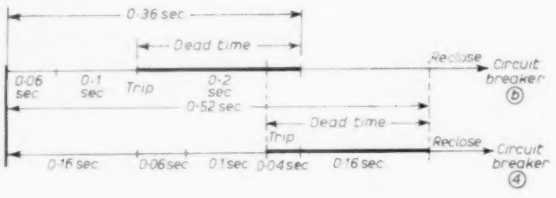


Fig. 7. Non-simultaneous operation time-cycle for circuit-breakers with identical characteristics

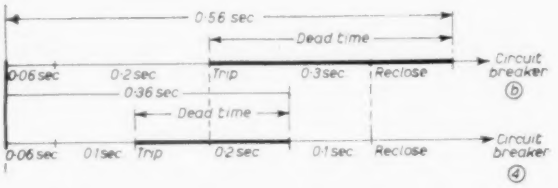


Fig. 8. Non-simultaneous operation time-cycle for circuit-breakers with dissimilar characteristics

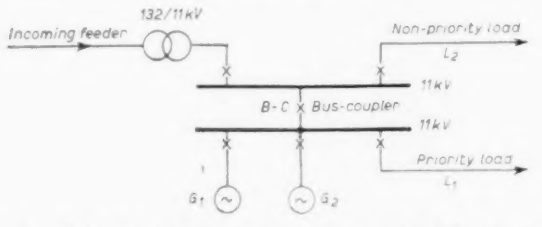


Fig. 9. Single line diagram of a factory network fed from local generators and public supply

severe conditions. For example, loss of synchronism is likely in the event of a three-phase fault should the number of tie-lines between the two stations be reduced suddenly after, or as the result of, disconnection of the faulty line. This may come about as the result of a redistribution of the power transmitted over the system which may exceed the permissible value in some feeders and distribution cables outside the fault area.

In general, stability of interconnected power systems can be achieved by the use of a proper combination of multiple transmission circuits, series capacitors, low-reactance alternators and transformers, high-speed voltage regulators, and high-speed tripping and reclosing circuit-breakers. Stability can be improved if the transmitted power—theoretically proportional to the square of the voltage and inversely proportional to the reactance of the system—is increased by reducing the reactance or increasing the voltage while the severity of the fault may be reduced by high-speed tripping and rapid reclosing. The first are concerned with the design of the alternators and transformers and the layout of the network, our problems being confined to the requirements of high-speed tripping and reclosing of the breakers. The objective is to secure reconnection of the tie-lines after a fault with such speed that any redistribution of the power over the network will have little effect on the behaviour of synchronous plant connected to the network.

High-speed fault clearance is, therefore, essential because, the longer the fault is permitted to continue, the greater are the chances of further damage to equipment and the worse is the deterioration of dielectric strength across the fault path. This would call for a longer dead-time to clear ionisation effects in the fault area which, in turn, jeopardises system stability. The latter will, therefore, depend on the duration of the fault.

Short fault-clearing time with short dead-time will ensure successful high-speed auto-reclosing of circuit-breakers on transient faults. In this manner we safeguard system stability since reconnection of the tie-line takes place before the phase angle between the two disconnected power generation systems exceeds the value for safe resynchronisation.

Auto-reclosing in large interconnected power systems differs from that for medium voltage networks deriving their supply from a single substation for, in the latter case, the dead-time is not related to system stability and the reclosing time (intentional time delay) can be regulated by adjusting the reclosing relay to suit system requirements. On the other hand, in interconnected power systems a dead-time exceeding the permissible value required to maintain stability (and which is subject to electrical and mechanical limitations) may result in loss of synchronism and, as a consequence, complete shut-down of either or both power stations. This is particularly liable to happen if the systems are tied via single circuits.

In general, for minimum break-time and high-speed reclosing, air-blast breakers are the most suitable. Circuit interruption in these devices takes place in two stages; first, there is the high-speed separation of spring-closed arcing contacts by a blast of air from an external source which is channeled to exhaust between the contacts and so remove ionised gas and metal vapour. This is immediately followed by the second stage, the opening of a series isolator. With the isolator fully open, the air is cut off and the sprung arcing contacts re-close. This action can be used to initiate the reclosing of the isolator with a minimum of dead-time, short enough to ensure synchronous stability of the system and, at the same time, to ensure that asynchronous (i.e. induction) motors on load at the time of the disturbance to "run over" the period without tripping their breakers on under-voltage. (Asynchronous motors are usually protected by no-volt coils or under-voltage relays.)

For high-voltage, solidly earthed transmisston systems, single-pole auto-reclosers are employed for protection against line-to-earth faults. Here the dead-time may be increased to around 20 cycles without jeopardising system stability while, by disconnecting the faulty phase alone, continuity of power loads is maintained for a longer period via the healthy phases. With single-pole tripping, however—and particularly in e.h.t. systems with feeders of considerable length—capacitative currents are induced in the disconnected phase line which are likely to increase the deionisation interval at the fault with consequent loss of system stability.

Another factor influencing dead-time is system configuration. An additional increase in dead-time can be tolerated in coupled power systems if the generating stations are interconnected by duplicate tie-lines (Fig. 1) so long as the reapportionment of power as a result of the disturbance does not cause the phase displacement between the alternators of the two stations to drift beyond a permissible value for satisfactory resynchronisation on reclosing.

It follows that successful reclosing will be dependent mainly upon (a) the capacity of the interconnected stations and (b), the configuration of the transmission system. For single circuits and three-phase transient faults, triple-pole reclosure may not be achieved successfully, but three-phase reclosure should be applied to parallel circuits though it has its limitations on single circuits.

The requirements for high-speed auto-reclosing on interconnected generating systems may, therefore, be summarised as follows:

(1) Minimum fault clearance time.
(2) Minimum break time on the associated breakers.
(3) Ability to open and lock out at speed after reclosure on a persistent fault.
(4) Single-phase reclosure, but three-phase trip and lock-out on a persistent single-phase fault in a system with a solidly earthed neutral.

In conclusion, the transmission of power over e.h.t. lines in solidly earthed systems is unthinkable these days without the use of high-speed auto-reclosing circuit-breakers. In medium voltage networks the number of reclosers in service, particularly on overhead lines, is increasing from year to year. When applying impedance protection to feeders of considerable length, the reclosing time may be reduced by overlap impedance protection.

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HEAT PUMP RECOVERS TEST LOSSES

AN installation providing space heating for a new building by utilising a heat pump to raise the temperature of low grade heat content cooling water produced on diesel engine test beds has been in operation at the works of Davey, Paxman and Co. Ltd. during the past winter. It is claimed to have operated at an efficiency comparable with an oil-fired boiler installation.

The decision to use a heat pump was taken with the knowledge that an ample supply of low grade heat would be available from the cooling water and because it was anticipated that valuable operating experience could be obtained by the company's engineers on this type of installation.

The heat pump utilises mechanical work of gas compression to extract heat from a low grade heat source and to deliver it to a heat sink at a higher temperature. The cooling water ponds associated with the diesel engine test beds form the low grade heat source. They have a large thermal storage capacity and this is being used to supply heat to a building requiring space heating of the order of 1,000,000 B.Th.U./hour.

Heat Pump

Hot water from the engine test beds flows into a sump and then over a V-notch weir before entering the cooling pond. Water is drawn off from the sump to the refrigerant gas evaporator in which Freon 12 circulates. From the evaporator, the gas passes into a 12-stage compressor and then through two delivery pipes to a condenser.

Water for space heating is circulated through the condenser by a separate electric pump and this water then passes to engine radiators in the new building. Air for space heating is blown through these radiators by electric fans. This system is said to enable radiator water temperature, which can be varied, to be kept to a minimum, so giving the installation a reasonably high theoretical performance-energy ratio.

The evaporator is designed with a generous heating surface clear of Freon liquid to ensure that dry vapour is supplied to the compressor, but any liquid Freon entrained in the suction line will be discharged into a "dead end" separator. The compressor has 12 cylinders, but normally only eight of these are in use. It is driven by a 130 h.p. induction motor and the rate of flow of coolant is varied by automatic valve-lifting gear, enabling 4, 6, 8, 10 or 12 cylinders to be used, depending on the building temperature requirements. From the compressor the Freon 12 passes into high efficiency oil separators before entering the condenser. The condenser can be run "dry" without liquid sub-cooling, and it is drained continuously to the evaporator by a float-operated expansion valve.

The installation is regulated by an automatic control unit similar to those used for control of oil-fired boilers and manufactured by Honeywell Controls. The controller ensures that water temperature is sufficient to balance the heat losses from the building for any outside temperature within the range of the controller setting. The required building temperature is altered simply by rotating a knob. The automatic control system selects the number of compressor cylinders required to meet the given air temperature conditions. Secondary control is also obtained from the radiator circulating water. The temperature of this water is limited to about 130°C. If for any reason this temperature tends to rise, due to dissipation from the radiators being less than that selected by the air temperature controller, the secondary control prevents condenser pressure becoming too high and thereby overloading the compressor.

The plant has been designed to be easily adaptable for experimental purposes and a dummy load heat exchanger is included to allow trials with various Freon 12 charges and other refrigerants. During these trials, the building can be heated by hot water supplied from sectional boilers.

V.F. link protects power lines

PROTECTION links for power systems costing about half conventional gear and operating with a voice frequency (v.f.) system using transistorised substation equipment have been introduced by English Electric.

Known as the SL.54 v.f. intertripping system, the equipment is suitable for use over GPO rented lines or on channels derived from power lines or other carrier systems. In addition to the transistorised circuitry, which ensures a low power consumption, logic circuits are also used to give reliable operation.

Application of the system can be illustrated by considering a step-down transformer connected to the remote end of a 33 kV feeder. If a fault occurs on the low voltage side of the transformer, the sensitive relays will detect it and trip the l.v. circuit-breaker. However, the h.v. circuit-breaker may not trip, especially if the l.v. fault current is restricted, as is usually the case, by an earthing resistor. A v.f. intertripping relay linking the two breakers could be arranged to trip the h.v. breaker when the l.v. breaker tripped on such a fault. On the other hand, a line fault to earth on one h.t. line would certainly trip the h.v. breaker, but it would still be possible for power fed into the l.v. side of the transformer to cause the two remaining unfaulted h.v. phases to rise to line-to-line voltage relative to earth with subsequent stressing of their insulation. Here, also, the v.f. intertripping relay would ensure that both h.v. and l.v. breaker were tripped, thereby ensuring complete isolation of the transformer.

Substation Equipment

The transmitter consists of an oscillator, amplifier and band-pass filter feeding signals to a pilot line or carrier channel via an isolating transformer. Normally the oscillator generates a frequency f_1 signifying that the circuit is healthy. During a fault, the "send" relay closes and the oscillator frequency falls to a value f_2. This change in frequency is detected at the receiver and can be arranged to operate the necessary protective gear.

The receiver and transmitter of each unit are connected to the line through a common isolating transformer. A matching transformer, band pass filter and variable attenuator in the receiver circuit ensure that the signals are isolated from transmitted signals and that the signals reach the receiver at a constant level. A frequency-discriminating circuit determines whether the received frequency is f_1 or f_2 and passes the resulting information on to logic circuits. There are two logic circuits, one gives warning of faulty operation of the SL.54 equipment or a supply failure, while the other causes local switchgear to be tripped when the frequency change is detected.

With the system correctly lined-up, not more than 45 millisec will elapse from closing of the send relay contact to operation of the trip relay at the remote end of the line. Under the worst conditions of line attenuation and ambient temperature, the delay will increase to a maximum of 75 millisec. To these times must be added inherent delays in the interconnecting lines, but they should not exceed a further 10 millisec.

Each unit consists of a line isolating transformer, channel unit and mounting panel. The channel unit and mounting panel are housed in a box measuring 20 in. by 12 in. square. The equipment can be used in ambient temperatures from −10°C to 55°C. Trip relay contacts are suitable for 100 V d.c. 0·3 A circuits and the alarm relay contacts for 300 V, 2 A d.c.

In designing the equipment, precautions have been taken to avoid false operation due to various causes, which, in addition to those mentioned above, also include cross talk from other cable circuits, inductive or capacitive discharges and variation or failure of the battery supply.

AROUND THE TRADE

BY PEREGRIN

SO the Budget has come and gone with hardly a ripple on the electrical sea; and we have been spared another body blow from purchase tax reductions. Just as well! For even my auditors were growing anxious about its effects. Usually they leave the worrying to me and add an extra pound or two to my bill for good measure. So with the perilous state of my finances temporarily assuaged I travelled hopefully to Earls Court and the Electrical Engineers' Exhibition. It proved to be even better than last year and I was very impressed by the lavish display of spotlights—many quite suitable for retail windows—which presented a brilliant spectacle when viewed from the balcony: also the specially made chandelier—a beautiful piece of craftsmanship which fitted in surprisingly well in a contemporary world. There was a comprehensive display of immersion heaters and several good groups of fluorescent fittings. Among the small stuff I found the coloured lampholders on Nettles' stand attractive but as I encourage my customers to buy light as well as beauty, I hope they stand up to the heat of the bigger lamps better than the ivory ones have done. There were several excellent displays of purely domestic appliances and decorative light fittings but I think this mixing of the domestic and the engineering undesirable. The domestic section of the trade is big enough to have its own exhibition and so leave the engineering section uncluttered by it. I sincerely hope the proposed domestic exhibition later in the year at Alexandra Palace will get the full support of all sections of the industry.

Exhibition Eavesdropping

While I am on information bent at exhibitions, I like to tag on behind other inquirers and listen—one so often gains titbits of information in that way. This time I found a body of enthusiasts at the MK stand criticising the single outlet in a twin-switch socket box. They pointed out that looping the necessary 7/·029 cables to feed two sockets was virtually impossible through one outlet. They had quite a point there and I was pleased to note the excellent and appreciative reception given to their views by the MK representative. I must say it is good to have the fully attentive and appreciative ear of the manufacturer—but more of that anon.

I was interested in the Electrikindler and found the salesmen very enthusiastic about both its performance and its probable life. I wonder! I have tried five electric firelighters up to date, starting with the pre-war Morphy-Richards, and all have proved incapable of standing up to the treatment meted out by the average housewife, who rarely reads instructions and almost never acts on them. Incidentally, what happened to the GEC effort, details of which appeared in the press last November?

Wholesalers' Links

I was interested to read of the link-up between the EWF and its European counterpart, of which Mr F. J. Blackwell, the retiring president of the EWF, spoke at their annual dinner. Apparently there are to be study groups, staff exchanges for training and a pooling of statistical information. Perhaps also they will discuss the Fair Trading Council and bring some ideas to bear on how to make it work properly. At the moment on the Continent they have plenty of experience of the free-for-all without it: manufacturers and wholesalers vying with one another to sell direct to the user and so squeeze the retailer out of existence. It is not the sort of thing we would welcome here and certain wholesalers could do well to read Mr Blackwell's remarks on associations and set their houses in order. Mr Blackwell also spoke on "channelled purchasing." This may have some good points in large towns where wholesalers abound but in country districts electrical wholesalers could not give sufficiently comprehensive service to their retailers, or justify their own existence.

Mr C. Richards, of Morphy-Richards Ltd., talked a great deal of common sense on the part the wholesaler could play. He also spoke sadly of those who had gone into the foreign markets when apparently all that was needed was intelligent planning with the British manufacturer plus the necessary cash to carry a decent stock. Sometimes, however, that intelligent planning seems to break down. How often in the past have I been kept waiting for Morphy-Richards goods to learn from the wholesalers that, say, January's stock order is still incomplete by June. Perhaps now their output is great enough to cope with this problem as well as their supplies to GUS.

Retail Bulk Buying

I have often said that the day of the small retailer was over unless he roused himself with some positive action. I was delighted to hear, therefore, that a group of hardy souls in the Midlands are banding themselves together for bulk buying on the lines of the Family Grocers' Association. I wish them every success. Indeed, if I was nearer I would make haste to join them, for, with the Restrictive Practices Act putting an end to all protection—ELFA is their latest victim—we may soon be faced with the free-for-all that pertains in the USA. And now the BoT are to enquire into individual price maintenance; just another nail in the coffin, but it gives a warning that all of us in the industry should heed.

Wage Level

Many electrical contractors today are finding themselves up against another problem—that of retaining skilled labour, and particularly so where installations are carried out on industrial premises. Skilled electricians are not overpaid and the position was succinctly expressed by one of my best chargehands when he left for a £16 a week maintenance job, "Why should I slave my guts out for a miserly pittance when machine morons are getting £18 per week," and knowing what a works maintenance job means, I silently agreed with him. It was, therefore, with pleasure that I heard at a recent meeting, a prominent member of the industry suggesting a sizeable early increase. More power to his elbow! It is time someone realized that the hire should be worthy of the labourer.

OVERSEAS NEWS

from our correspondents abroad

CANADA

Looking Ahead

The British Columbia Power Corporation has sufficient generating reserves to meet the needs of its consumers until nearly the end of the 1960's, according to Mr A. E. Grauer, the president. Much of this cushion has been effected by the establishment of the gas-fired thermal plant now under construction at Burrard Inlet. Mr Grauer believes that as it will take until about 1968 for either the Peace or the Columbia to be developed, any substantial delay in these two projects could put BC Power customers in a serious position. It was the fear of such delay that caused BC Power to purchase coal deposits at Hat Creek near Lillooet. The coal deposits acquired had a power generating capacity equal to the full development of the Peace River, or the Upper Columbia, and four times the present BC Electric generating capacity. Hat Creek coal could support a 2,000 MW plant for 40 years from proven reserves and experts believe that further exploration would show these reserves could be doubled. The cost of generating at Hat Creek would be comparable with the costs of the present generating system.

Saskatchewan Report

A total of 132 MW of new generating capacity was placed in service during 1959 by the Saskatchewan Power Corporation, raising the system capacity to 450 MW. A further 266 MW of plant is under construction or projected, including the 201 MW initial stage of the Squaw Rapids hydro-electric scheme for which the contracts for six Francis type turbines and associated 33,500 kW generators have already been placed. A total of 214 miles of 138 kV transmission line and 165 miles of 72 kV line was completed during the year. In addition, pole-setting was virtually completed on the Saskatchewan portion of the 230 kV interconnection with Manitoba, and some 45 route miles of conductor were strung. The Queen Elizabeth power station at Saskatoon and the Boundary Dam station at Estevan are now interconnected through major load centres with two 138 kV lines. Rural electrification was extended to 4,150 new consumers, including 3,775 farms, involving the erection of 3,103 miles of s.p. line. Now in the final three-stage of the rural electrification programme, the corporation serves over 55,000 rural consumers, including more than 51,000 farms. The annual report of the corporation for 1959 also notes that the trend away from coal as a major fuel for power production continues. Consumption of natural gas by the corporation's power stations amounted to 8,653,410 million cu ft last year.

U.S.A.

Glen Canyon Order

The order for the supply of eight 155,000 h.p. water turbines for the Glen Canyon power project, has been awarded to Baldwin-Lima-Hamilton, of Philadelphia, almost as expected. That concern's bid of $6,392,000 just pipped the English Electric Co.'s $6,214,552 offer, which was the lowest of seven tenders received by the US Reclamation Bureau of the Interior Department. As we earlier reported, English Electric Co. submitted that the Baldwin-Lima-Hamilton bid was not a domestic bid under the terms of the Buy American Act, because much of the material would be imported from Belgium. Actually 42·7% of their bid represented parts from Belgium, but as the Act permits up to 50% for recognition, the Department held that the offer complied in this respect.

MEXICO

500 MW Station Planned

Anticipating a continued increase in unit sales of around 10% annually, the Mexican Light and Power Co. have planned the erection of a new thermal power plant in the central area of the system. This plant is planned to have four 125 MW sets, the first of which should be in service by the end of 1962 and the second unit one year later. Consultations with the authorities and the equipment manufacturers are now in progress, the directors state.

RHODESIA

Smelting Plan

The Rhodesian Broken Hill Development Co. Ltd., have decided to install an Imperial smelting furnace at a cost of about £4,000,000, of which amount some £400,000 has already been spent on securing rights and designs of the process. The development is expected to be completed by 1962, and will entail the installation of a third generator at the Lunsemfwa hydro-electric site at a cost of £350,000. When in operation, the process is expected to improve the combined recovery of lead and zinc from about 60% to over 85% from ore mined and also make possible the recovery of some 200,000 long tons of these metals from presently untreatable stocks.

PAKISTAN

Power Warning

Threats of temporary load shedding unless consumers economise in their electricity consumption have been made by Mr A. G. Khan, managing director of Karachi Electric Supply Corporation. He has warned that the corporation was passing through a very difficult period, and co-operation from consumers was needed. He suggests domestic consumers should reduce their load by 15% to 20% during the peak hours. Meanwhile every effort is being made for speedy installation of the interim 15 MW of generating capacity scheduled for commissioning in August, and the installation of 66 MW scheduled for operation in early 1962. The difficult situation was likely to continue until the 81 MW of plant was operating. It is proposed to apply to the World Bank for a fourth loan for a new station to be known as "C" steam station, which will be the final station designed to accommodate all future extensions and which, if the loan is sanctioned, is expected to come into commission by about 1965, he said.

INDIA

Nuclear Aim

The Atomic Energy Commission of India is now planning to develop reactors which will utilise the country's thorium reserves. To be able to produce cheap and abundant power, India, it is stated, has to base its nuclear power programme ultimately on thorium, which is available in abundance in the country. The annual report for 1959-60 of the Department of Atomic Energy outlines the plans of the commission for the development of a nuclear power programme suited to India's requirements. Preliminary work on the first nuclear power station, which will be located between Bombay and Ahmedabad, and which will serve both the regions, has made considerable progress and it is expected that the contract for the supply

of the plant will be finalised early next year, it is stated. The station is expected to go into operation in 1965 and will produce 300,000 kW. The original decision was to set up a reactor of 250,000 kW, but as there seemed to be considerable operational advantages in providing this capacity with two reactors, it is now proposed to set up two reactors of 150,000 kW each at this station.

Work Started

Construction has started on the Gandak irrigation and power project, a joint India-Nepal venture. The plan provides for two power stations, one on the Nepalese side of the Gandak River and the other on the Indian side, each with a firm capacity of up to 10 MW. A barrage 2,749 ft long is to be constructed at Bhaisalotan, with one end in each country. Total cost of the entire project estimated at Rs 505 million, is to be borne wholly by India, who will also erect the transmission lines. From this grid Nepal will be assured a supply of firm power at actual cost of production and transmission.

Wind Power

Recent research on wind power in India has yielded encouraging results, it seems. But, initially, the plan is to build low-cost windmills suitable for lifting water for small-scale irrigation and for providing water supply to village homes. According to the latest studies, it has been established that wind power as a source of energy can be utilised in the Jodphur region, in Saurashtra, the Himalayan foothills, Belgaum and Dharwar districts, Coimbatore and Palghat districts, Cape Comorin and the hilly tracts of Assam. Isolated areas along the east coast near Madras, Visakhapatnam and Cuttack. Encouraged by these results, the Government is now planning to install about 20,000 windmills during the third plan period.

AUSTRALIA

Success in Rain Making

Scientifically controlled rain-making tests in connection with the Snowy Mountains hydro-electric scheme have increased by 15% the rainfall in a selected area. This was stated in Australia last week by Dr F. W. G. White, the chairman of the Commonwealth Scientific and Industrial Research Organisation. Tests have been proceeding for five years, which, according to Dr White, "is long enough to prove the infallibility of the method used given favourable conditions." It is understood that tests have been carried out in the New England district of north east New South Wales and also in the Warragamba Dam area, west of Sydney and in the Mount Lofty ranges near Adelaide. The method used in Australia is to "seed" clouds with a mixture of silver iodide, sodium iodide and acetone, burnt as a hot flame underneath an aircraft flying through clouds. It has been claimed that one aircraft has been able to seed clouds and start rain falling over an area of as much as 4,000 sq miles.

Northern Rivers Supply

Operations by the Northern Rivers County Council electricity undertaking, NSW, during the 12 months ended 31 Dec. last resulted in a net surplus of £78,266 despite an adjustment in tariffs which reduced revenue by about £60,000. Units sold increased by 8·35% to 123 million, of which over half went to residential and farm consumers. The council operates one steam, one hydro and two diesel stations and, along with the Mines Dept. and the Electricity Commission of NSW, has been exploring known coal deposits. But results of last year's efforts were most disappointing and drilling is to be tried elsewhere. The council also has a power exchange arrangement with the Electricity Commission, and conferences have been held regarding a bulk supply at 132 kV via Armadale. At these it was decided to have this tie line in operation by March, 1963.

Nearly Ready

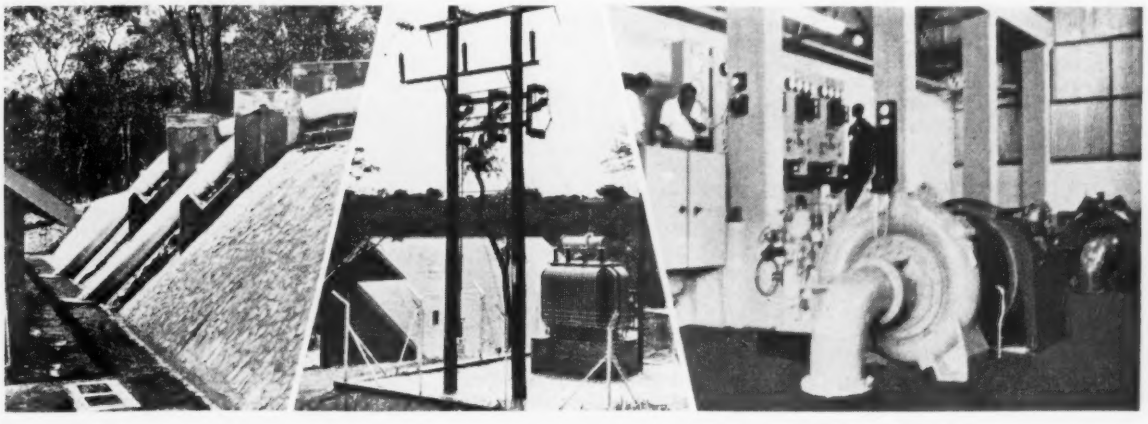
The new Port Augusta "B" power station of the Electricity Trust of South Australia is expected to be in commission within the next three months. Erection of a new 220-mile long 275 kV transmission line to Magill substation is virtually complete. Installation of the first of four 60 MW English Electric turbo-generators is in the final stages. Three more similar machines are to follow. The boilers are being provided by Riley Dodds (Australia) Ltd.

HONG KONG

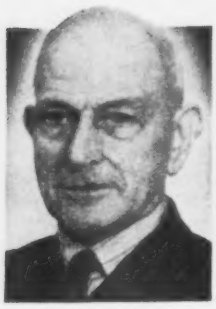
Mass By-pass

Illegal by-passing of the meter is commonly known throughout the world, but a much wider racket was recently uncovered in Hong Kong. There, three Chinamen apparently connected lines from a main line of the China Light and Power Co. to a village in Kowloon where the latter concern had made no provision for a supply. Telling villagers they were employees of the power company, they had installed lamps in 50 huts for a fee, before their wrongdoing was discovered.

Installations for the Kasama hydro-electric station, to which we referred on 14 April, are shown below. (The station was officially opened on 20 April.) Left is a view of the penstock as it enters the station. In the centre is a 33 kV step-up substation with the power station in the background, while on the right is an interior view of the station which has three 300 kW sets with alternators by Bruce Peebles and turbines by Gilbert Gilkes and Gordon. The station is located at Chishimba Falls on the Luombe River, some 20 miles west of Kasama township to which the 33 kV line runs. Voltages of 11 kV and 380/220 are employed in the network in and around the township and for rural lines to the new Mungwi African development area, the Chiba Dam pumping station, Malima Prison and other points. In Kasama itself, electricity is being distributed under a special scheme to several hundred African houses. The airport, hospitals and town water pumping station will also be changing over from their own diesel driven plant to public hydro-electric supply

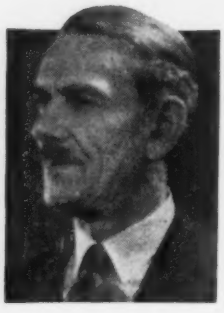


Personalities *in the industry*



Mr F. W. Gardner

Mr H. H. Mullens



Mr Reginald Cox

Mr J. A. Holroyd

Mr R. Hebditch

Mr F. W. Gardner, B.A., A.M.I.C.E., is relinquishing the position of chairman of C. A. Parsons and Co. Ltd. at the annual general meeting on 11 May, but he has agreed to remain for a time as a member of the board. His successor as chairman will be **Mr H. H. Mullens,** B.SC., M.I.E.E., formerly deputy chairman. Mr Gardner was invited to take over the responsibilities of chairman following the tragic death of Sir Claude Gibb in January, 1959. He had been director and general manager of the company from 1944 to July, 1956, when he retired from active service, while continuing as a director. Educated at King's School, Chester, he proceeded to Queen's College, Cambridge, where he graduated in Mechanical Sciences, obtaining his B.A. degree. He joined Parsons as a student apprentice in 1912, and after war service returned to Heaton Works, becoming head of the turbine design staff. In 1938 he was appointed chief engineer to the company, and in the following year became a director. Mr Mullens, who is also chairman and managing director of A. Reyrolle and Co., joined the latter concern in 1954 as managing director after being chairman of the North Eastern Electricity Board from 1948 to 1954. Prior to that he held various appointments with the North Eastern Electric Supply Co., ultimately as deputy general manager. Mr Mullens took over the chairmanship of Reyrolle's from Sir Claude Gibb in October, 1958, and on the death of the latter also became deputy chairman of C. A. Parsons and Co.

General works manager of George Kent Ltd., **Mr J. F. Willsher** has been appointed a director of the company.

Mr T. Ingledow, who has been chief of the British Columbia Electric Co.'s various power projects since 1944, retired from the position of vice-president of the British Columbia Power Corporation at the beginning of this month. He has now joined the recently formed International Power and Engineering Consultants Ltd. to whom we referred on 31 March.

Chairman of the Eire Electricity Supply Board, **Mr R. F. Browne** is retiring from that position at the end of this month. (*ESH, page 178.) He joined the board from the Revenue Commission in 1930, and was its second chairman.

Mr D. B. Lee and **Mr K. H. Vernon** have been appointed electrical appliance group representatives for the N.W. Region of Philips Electrical Ltd.

At present Reader in Physics in London University, **Dr D. MacKay** has been appointed to the Research Chair in Communication at the University College of North Staffordshire, founded by Granada Television.

On the occasion of the company's annual general meeting a presentation was made to **Mr Reginald Cox,** London director of Yorkshire Switchgear and Engineering Co. Ltd., by his co-directors, in appreciation of his 39 years' service with the company. Mr Cox will continue as a director of the company and, although he is retiring from his more executive duties as London manager and will be in less frequent attendance at Grand Buildings, Trafalgar Sq, he will serve the company in a consultative capacity and will endeavour to maintain contact with his many friends in the industry. **Mr J. A. Holroyd,** M.A., has been appointed acting London manager for YSE, and **Mr R. Hebditch** has been similarly appointed in respect of the subsidiary company, EMM Co. Both Mr Holroyd and Mr Hebditch have been directly assisting Mr Cox over the past few years and will continue to operate from Grand Buildings as heretofore. Mr Reginald Cox, a Liveryman of the City of London, joined Dick Kerr and Co. Ltd. in 1906 and remained with them until 1913. He was then transferred to Watlington and Co. Ltd. (in charge of Traction Sales Department) which later became the Britannia Lamp and Accessories Co. Ltd. A further amalgamation took place in 1919 with English Electric Supplies Ltd. and Siemens Dynamo Works Ltd., resulting in English Electric Siemens Supplies Ltd. He joined his present company in 1921.

Mr R. E. Robinson retired on 31 March from the position of assistant managing director of the GEC, being responsible for the Telecommunications and Electronics Group of the company at the age of 73, after 55 years in the telephone industry. A Londoner, Mr Robinson was educated at Finsbury Technical College and his liking for mathematics and science took him into the new and expanding field of telephony. In those days, most exchange equipment was made abroad and, after 18 months' practical experience on exchanges, Mr Robinson took an engineering appointment with the Bell Telephone Co. in Antwerp, which was supplying equipment to this country. In 1908, Lord Hirst, recognising the potential value of the telephone industry, formed a new subsidiary of the GEC at Salford, to manufacture the equipment in this country. Mr M. S. Conner, an American specialist in telephone engineering, was engaged to manage the new works and Mr Robinson was engaged as chief engineer. In this way, the first company to manufacture modern telephone equipment in this country, the Peel Conner Telephone Co., began. The telephone works was moved from Salford to its present site in Coventry in 1920, and Mr Robinson went there as sales manager. Shortly afterwards the GEC began to pioneer the manufacture of radio equipment in Coventry. The group has expanded continually, until today the GEC is the largest single employer of labour in Coventry. In 1942 Mr Robinson became deputy general manager of telephone works and radio works and, in 1945, he was made general manager and a director of the company. Finally, he became one of the three assistant managing directors of the GEC in November,

1957. A Freeman of the City of London and a Past Master of one of the old London Livery Companies (the Playing Card Makers), he is also one of the Knights of the Round Table, one of whose principal functions is to welcome new ambassadors to the Court of St. James. His retirement was marked by a number of departure ceremonies and included the presentation of three line and wash drawings from his Coventry colleagues, and a large translucent globe of the world from the overseas branches.

Formerly London sales manager of Scottish Cables Ltd., **Mr M. H. Beattie,** E.R.D., M.I.E.E., has been appointed assistant sales manager (power cables) to British Insulated Callender's Cables Ltd. Mr Beattie was educated at Glasgow and Kelvinside Academies and the Royal College of Science and Technology, Glasgow. After war service he joined Scottish Cables Ltd., early in 1946 and, two years later, became London sales manager, holding this position until his present appointment.

Mr J. D. Clare, B.SC., M.SC., A.M.I.E.E., has been appointed Director of Guided Weapons Research and Development (Air) at the Ministry of Aviation, as from the end of April, in succession to Air Commodore H. B. Wrigley, C.B.E. Mr Clare was employed in the development laboratory of the General Electric Co., at Coventry from 1940 to 1945 and was afterwards a senior engineer with Sobell Industries for five years. He served at the Ministry's Royal Radar Establishment from 1950 to 1955 as section leader responsible for the centrimetric receiver system on new fine control radar and low altitude G.W., and since 1955 as superintendent on surface-to-air guided weapons.

Mr J. Campaigne, A.M.I.E.E., joined Evershed and Vignoles Ltd. on 19 April, as manager of the Instrument Division. For the last four years he has been sales manager of another company within the Evershed Group—the Record Electrical Co. Ltd., of Altrincham.

Mr C. H. Offord, M.B.I.M., M.I.W.M., M.S.I.T., general manager of the Newhouse (Lanarkshire) factory of Honeywell Controls Ltd., has been made a director of the company. Since joining the company in early 1949, Mr Offord has been successively joint works manager, works manager and general manager. He has served on several committees of the Society of Instrument Technology and is a member of the board of directors for the Scottish Electrical Training Scheme.

Mr C. W. Oatley, M.A., M.SC., M.I.E.E., lecturer in mechanical sciences in Cambridge University, has been elected Professor of Electrical Engineering there. He joined the staff of the Engineering Department at Cambridge University in 1945. During the war he worked on radar for the Ministry of Supply and in 1944-45 was in charge of the scientific work at RRDE, Malvern. He was educated at Bedford Modern School and St. John's College, Cambridge, where he took parts of the Natural Sciences Tripos, specialising in physics, and graduating in 1925. After two years in industry he joined the physics staff of King's College, University of London, where he remained till 1939. Mr Oatley was chairman of the IEE Radio Section in 1954-55. He takes over his new duties from 1 Oct. next.

Mr H. G. Furlong, M.I.E.E., technical representative for B. S. and W. Whiteley Ltd. in London and the south of England, retired on 31 March after approximately 30 years' association with the firm. Mr Furlong is succeeded by **Mr D. H. Sims,** A.M.I.E.E., who joins the company with experience in the usage of Elephantide pressboard in electrical equipment and who is now based on Whiteley's London office at Halton Hse, Holborn, E.C.1.

Mr H. V. Slade, M.B.E., J.P., M.I.MECH.E., and **Dr G. A. V. Sowter,** PH.D., B.SC., M.I.E.E., have been re-elected chairman and vice-chairman, respectively, of the Radio and Electronic Component Manufacturers' Federation. **Mr C. M. Benham** has been re-elected treasurer.

Mr V. W. Press has resigned as sales director of Lancashire Dynamo Nevelin Ltd. to take up a similar appointment with the Limit Engineering Group where he will be responsible for implementing the sales expansion programme following the acquisition of an additional factory at St. Albans. Joining Lancashire Dynamo in 1934 Mr Press was appointed London manager in 1951 and transferred to Nevelin in 1955 as sales manager, switchgear division, being appointed sales director for all products a year later.

Mr D. C. Lorkin, F.C.I.S., F.A.C.C.A., has relinquished his position as managing director of Lancashire Dynamo and Crypto Ltd., and other directorships in the group. Mr Lorkin played a leading

Mr D. C. Lorkin, left, receives the gold cigarette case

part in building the Lancashire Dynamo organisation since he joined the Willesden Works in 1932. He became commercial manager in 1935, joint general manager in 1942, a director in 1946, joint managing director in 1951, and managing director in 1958. He now plans some measure of relaxation. At the annual works party earlier this month, Mr Lorkin was presented with a gold cigarette case as a mark of esteem from his colleagues, staff and workpeople to signal his retirement.

As from 1 May, **Mr N. H. Vaughan,** who joined Philips Electrical Ltd. in July, 1958, as a commercial assistant, is appointed a representative for the Electrical Appliances Group in the company's north-west region. From the same date, **Mr D. Whiteling** is appointed an ELA (Electro-acoustic) representative.

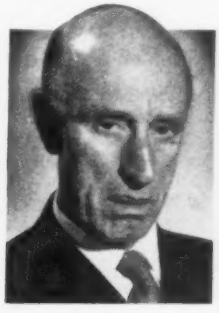
The new mayor of Higham Ferrers (Northants) is to be **Councillor Thomas Charles Oberman,** joint managing director of J. H. Oberman and Sons Ltd., electrical contractors, and managing director of Oberterm Electrical Co. Ltd. and a director of Delta Electric Ltd.

Elcontrol Ltd. have now established a Special Products Division to control design, production and application sections for dealing with customers' requirements. In charge of this division is **Mr G. S. Potter.**

**Denotes revision to the "Electricity Supply Handbook, 1960."*

Mr M. H. Beattie

Mr C. H. Offord



Mr H. G. Furlong

Mr D. H. Sims

Mr V. W. Press

Mr N. R. D. Gurney

Mr I. A. Ferguson

Mr. J. Cannell

New appointments in the Large Electrical Machine Sales Department just announced by Associated Electrical Industries Ltd. Heavy Plant Division reflect that Division's increasing business in connection with the steel and non-ferrous metal industries. In order to concentrate on furthering the Division's interest in these markets, at home and abroad, **Mr N. R. D. Gurney,** A.C.G.I., M.I.E.E., has relinquished the position of manager, AEI Heavy Plant Division's Large Electrical Machine Sales, (Manchester) but remains a member of the executive of that Division. **Mr I. A. Ferguson,** M.I.E.E., formerly manager, Large Electrical Machine Sales (Rugby), assumes responsibility for the entire department, and **Mr J. Cannell,** B.ENG., A.M.I.E.E., is now appointed assistant manager. Mr Gurney was educated at the City and Guilds Engineering College. After serving a vacation apprenticeship at the BTH Willesden Works, he took a college apprenticeship course at Metropolitan-Vickers, Trafford Park. In 1931 he was awarded a General Electric Fellowship by Metropolitan-Vickers to study steel mill engineering at the G.E. Works at Schenectady, USA. Returning to England in 1932, Mr Gurney joined the Rolling Mill Department at Trafford Park. Except for a period during World War II when he became assistant superintendent of the Gun Carriage Department at Trafford Park and spent a year in Washington with the British Admiralty Delegation in connection with Admiralty fire control work, Mr Gurney remained with the Rolling Mill Department until 1950. He then formed the Electrical General Engineering Department, being appointed chief engineer. On the formation of AEI Heavy Plant Division in 1958, Mr Gurney became a member of the executive and was also appointed manager of Large Electrical Machine Sales, Trafford Park. Mr Ferguson served an apprenticeship with the BTH, and in 1939 joined Construction Department at the Rugby Works. Two years later he obtained a commission in the Royal Navy and served in aircraft carriers until 1946. He then rejoined BTH in Plant Contracts Department. In 1948 Mr Ferguson became a senior engineer in the company's Mining Department, being appointed assistant manager of the department in 1954 and manager two years later. On the formation of AEI Heavy Plant Division in 1958, he became manager of Large Electrical Machine Sales Department at Rugby. Mr Cannell joined Metropolitan-Vickers as a college apprentice in 1939, the same year that he graduated at Liverpool University. During the war he was occupied with work on military equipment. In 1950 Mr Cannell visited Mexico on behalf of Metropolitan-Vickers and made a survey of that country's industries, with particular reference to its heavy plant requirements. He has also visited Canada and the Continent, investigating the market for waterwheel generators and other large machines.

Our note on 14 April, page 613, concerning the appointment of **Mr F. C. W. Clark,** A.M.I.E.E., as engineer of the Lanarkshire area should, of course, have referred to the South of Scotland Electricity Board. We trust no readers thought the Eastern Board were extending their sphere!

In order to reduce his commitments in the City, **Mr D. G. Nairn,** O.B.E., chairman of J. and F. Stone Lighting and Radio Ltd., will not seek re-election as a director at the annual general meeting in November. At the request of the remaining directors, his partner, **Mr F. S. Bassett,** has been appointed a director with a view to his succeeding Mr Nairn as chairman.

OBITUARY

Prof. C. J. Bakker, who had been director-general of the European Organisation for Nuclear Research (CERN), since 1955, was killed in an air crash near New York on 23 April. He was 56 years of age.

Mr Hugh S. Watt, a director of William McGeoch and Co. Ltd. since 1950, died on 15 April. For several years previously he had been manager of the company's Electrical Department. During the last war he worked very closely with the Admiralty in the production of important electrical equipment for naval and merchant ships. He was the inventor of a new type of watertight fitting and other electrical devices, now widely used in ships' wiring.

NEW LITERATURE

Sells' Building and Civil Engineering Trades List

IN addition to a change in title—indicating the expansion into civil engineering—this annual has also been remodelled with a thumb index to provide quick reference to each of eight special sections. Among the 2,700 product headings many electrical goods are listed, but it gives a very wide coverage of the various products and services used in the building trade generally, which should make it a very useful reference book. Published by Business Dictionairies Ltd., 700 pages, 10 in. by 7¼ in. Price 40s.

Process Integration and Instrumentation

THE eighth in EDA's series "Electricity and Productivity" this, in common with its predecessors, is directed primarily at industrial managers and production executives, particularly of the medium and smaller firms who may not be able to support specialist staff solely on instrumentation development. It is, therefore, presented in a refreshingly readable form without the mathematical arguments which would have been required for a work addressed to instrument or control engineers. The magic word "automation" is necessarily much in evidence, but sensibly regarded as the goal to which measurement and its application ultimately lend. The book outlines the means by which the variables occurring in manufacture and processing can be sensed, measured and controlled with the object of achieving a more completely integrated production. It shows that the steps from measurement to control are necessarily complex, impinging on a wide variety of technological skills. Published by the Electrical Development Association, 2 Savoy Hill, W.C.2, 204 pages, 8½ in. by 5½ in. Price 8s 6d (postage 6d extra).

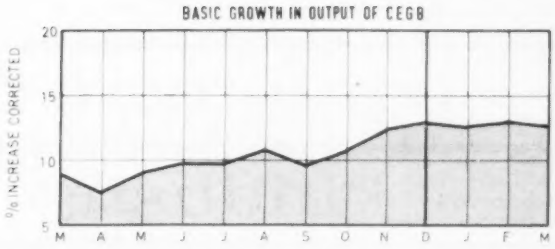
British Journal Photographic Almanac, 1960

edited by A. J. Dallaway

AMONGST articles in this year's edition of this firmly established publication, is one on world trends in colour films; another deals with photography of aircraft. As usual, the almanac contains lists of photographic materials, including technical information necessary for processing, while a special feature is a 12-page section dealing with electronic flash factors and developing times. There is a directory of approved repairers for cameras as well as an extensive buyers' guide to new apparatus and materials. The almanac is extensively illustrated and includes a 32-page photogravure supplement. Published by Henry Greenwood and Co.; 620 pages; 7¼ in. by 4¼ in. Price 8s.

POWER SUPPLY

statistics for March



IN March, both the number of MW of new plant brought into service by the CEGB and the number of units generated attained quite high figures for this time of the year. 360 MW of plant were commissioned, including the second 120 MW at Agecroft "C" station.

Units sold by the CEGB totalled 9,389·4 million, an increase of 22·4% on the corresponding month last year. This figure, when corrected for daily temperatures and number of working days, becomes 12·7% or slightly less than the figure for February. During March the SSEB supplied 755·9 million units and the NSHEB 170·6 million units. These totals show increases of 18·7% and 18·9% on March last year. In contrast with the CEGB, neither of the Scottish boards commissioned plant during the month.

The output capacity of installed plant owned by the CEGB and the two Scottish boards, rose during March by 240 MW to 28,301 MW. The discrepancy between this increase and the capacity of new plant commissioned may be partially attributed to decommissioning of old plant. The capacity of the two Scottish boards remained at the figures of 1,656 and 1,043 MW for the SSEB and the NSHEB respectively. An increase in electricity generated by 20·8% to 11,023 million units was achieved for an increase of coal consumption by the three generating boards of 16·9% over last year to 3,965 thousand tons. Generation by water power was also up on March last year by 26·4%, although at 200 million units this represents a relatively small fraction of the total electricity generated.

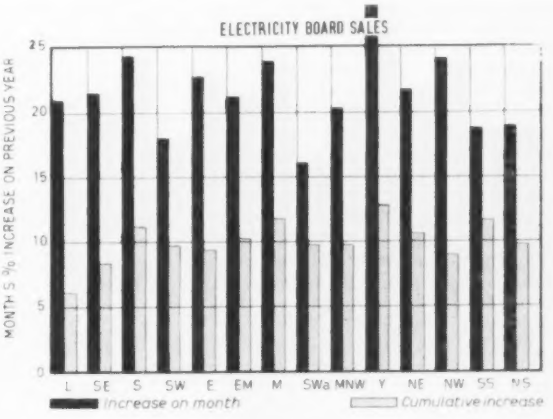
New Plant commissioned by CEGB in March

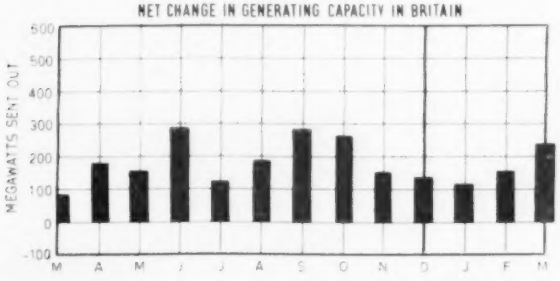
Station (Division)	Turbo-alternator size (MW), maker	Boiler size (klb/hr), maker
Belvedere (London) ...	60 EE	550 JB
Plymouth B (S. West)	60 AEI (BTH)	550 B & W
South Denes (Eastern)	60 RW	550 M
Agecroft "C" (NW, M, N. Wa.)	120 AEI (MV)	860 IC
Bold B	60 GEC	555 JT

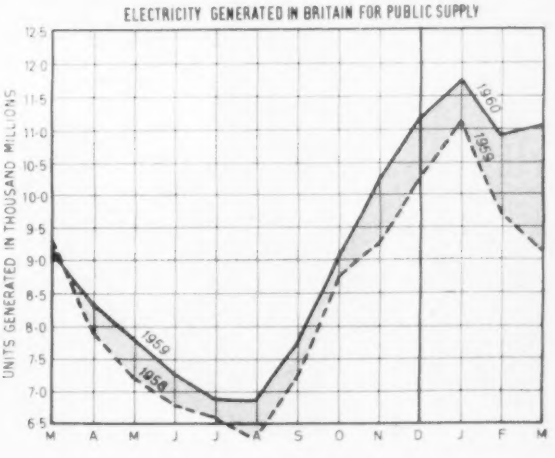
Electricity Board Sales Progress in March

Board	Electricity sent out in millions of units	% increase on Mar. 1959
London	891·4	20·9
South Eastern	589·5	21·5
Southern	787·2	24·3
South Western	357·9	18·0
Eastern	950·3	22·8
East Midlands	774·4	21·2
Midlands	1,043·5	23·9
South Wales	535·0	16·1
Merseyside and North Wales	581·7	20·3
Yorkshire	1,003·4	28·1
North Eastern	564·5	21·7
North Western	987·1	24·2
Direct supplies by CEGB	323·5	20·0
CEGB Total	9,389·4	22·4
South of Scotland	755·9	18·7
North of Scotland	170·6	18·9

Table excludes area board purchases from other sources.







equipment for industry

Automatic coil winding

WINDING, taping and subsequent ejection after winding are performed automatically by an automatic coil-winding machine, recently announced, of German manufacture. Coil formers are assembled on an indexing table. A rotating guide attached to a face plate winds one coil, while other coils are being taped and ejected. Versions are available for winding field, solenoid and radio coils, and these can also be equipped with bonding attachments for thermoplastics wire. *R. H. Cole Ltd., 2 Caxton Street, S.W.1.*

Machine tool control

POSITIONING and sequence control units for machine tools are now available incorporating logic control utilising printed circuits and cold-cathode valves. The use of logic circuits means that contactors and similar electromechanical devices are practically dispensed with, so reducing maintenance requirements. Transistorised printed circuits are said to enable the size of equipment to be considerably smaller than conventional control gear. Positioning equipment has already been successfully applied to a jig borer. The position of the machine work table is sensed in two perpendicular directions by rotary digitisers, and these control the table lead screw driving motors. These motors give two speeds, a high traverse rate of 90 in./minute and a low "homing" speed of up to 12 in./minute with positioning to ±0·0005 in. Sequence control equipment gives triggering and timing facilities which can be used to control a number of simultaneous or successive operations. This equipment has so far been applied to a vertical broaching machine and also to an injection moulder. *Electronics Division, GEC Ltd., Magnet Hse, Kingsway, W.C.2.*

Class H varnish

A SILICONE resin, R 212, is now available as a coating and bonding varnish for electrical components operating at Class H temperatures. The resin has a fast curing time and high flexibility, suiting it for coating glass cloth. It also has a relatively high solid content and is free-running so that it will also give good penetration if used with asbestos and mica papers. The resin may also be used for bonding mica splittings since it has a short drying time and good adhesion. *ICI Ltd., Millbank, London S.W.1.*

Cooling medium-size transformers

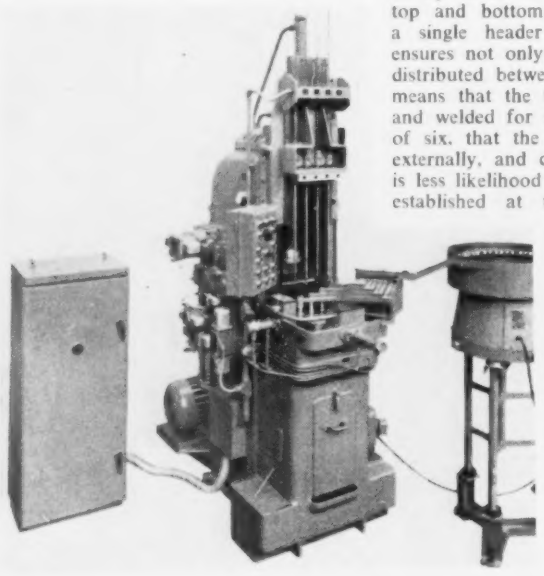
A COOLING unit for transformers rated from 500 kVA to 2 MVA claimed to give better cooling and simpler tank construction than the usual separate cooling tubes, has recently become available. The unit consists of three vertical elliptical tubes, which may be up to 20 ft in length, attached to top and bottom headers. The use of a single header for the three tubes ensures not only that the hottest oil is distributed between these tubes, it also means that the tank must be punched and welded for only two holes instead of six, that the tubes may be welded externally, and consequently that there is less likelihood of corrosion becoming established at the tube joints. The elliptical header section offers less resistance to vertical air flow than circular section tubes and the greater cooling efficiency of the tube group permits larger spacing between units than with conventional circular tube banks for the same cooling effect. The tubes are welded into the headers after a forming process which ensures a leak-free joint. *Washington Engrg. Co. Ltd., P.O. Box No. 4, Washington, Co. Durham.*

Rheostat added to range

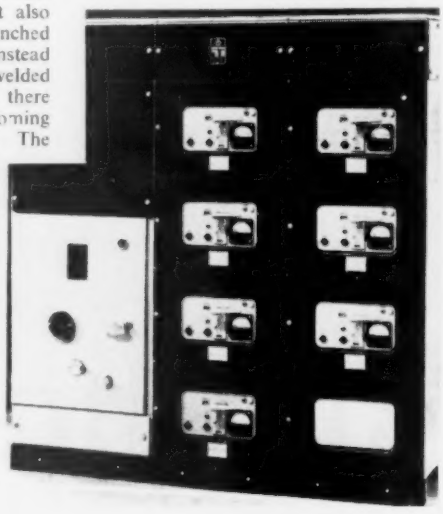
THE "Enbray" rheostat unit, supplementing a well-known extensive range, is constructed to permit easy adaptation for back-of-panel mounting by loosening only two screws. The operating knob, dial plate and operating shaft are thus readily detached. Wire mat resistance elements are used with glass-sleeved and crimped connections. The three sizes of rheostat cover a range from 200 W to 1 kW, and the face plate can have up to 41 contacts. The rheostat is enclosed in an expanded metal guard and it also has a moving contact with replaceable shoe. *E. N. Bray Ltd., Britannia Rd, Waltham Cross, Herts.*

Cubicle has plastics finish

PLASTICS coated sheet steel is used for the construction of a new range of multi-unit draw-out contactor panels. The material is Stelvetite and it consists of p.v.c. laminated to high quality steel sheet. This material can be drawn and welded to form the cubicle components without damage and has the great merit of being easily cleaned and not being easily scratched or marked. An attractive appearance is given to the panels by using light green and black finishes. The panels are suitable for direct-on-line motor starting up to 200 h.p. and each starter unit can be withdrawn from the cubicle for inspection and maintenance. The range of equipment includes circuit-breakers, switchfuses and slip-ring motor starters. These can be assembled into compact composite switchboards. *Baldwin and Francis Ltd., Eyre St, Sheffield 1.*



A broaching machine controlled by the GEC sequence control system



Use of p.v.c. covered steel for these contactor panels gives an attractive appearance and also provides a surface easily cleaned but which does not readily scratch

for the electrical trade

New-look kettle

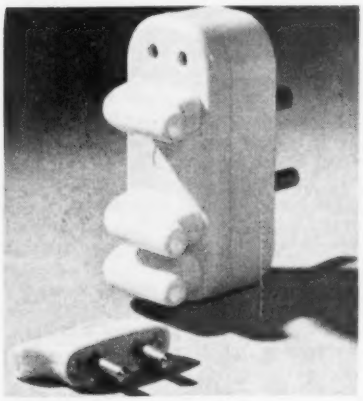
THE "Miniway" range of two-pint electric kettles is to be replaced by a new model, the "Miniway Rex." It has a modern-looking broad shallow vessel with finger-grooved handle for easy gripping and incorporates automatic emergency cut-out mechanism. Price is £2 15s 6d, loading 750 W. A non-automatic model is available at £2 9s 10d. In the near future a 12 volt car kettle may be included in the range. *Metway Electrical Industries, Canning St, Brighton.*

Commercial mercury batteries

MERCURY batteries, available until now only for certain specialised applications, are now being offered for more general distribution. Mallory Batteries Ltd., who have been manufacturing them for scientific and industrial use, have modified their ranges to suit more general applications, bearing in mind the increasing popularity of new miniature transistorised radios, clocks, tape recorders and similar equipment. Ranging from 1·35 volt (single cell) to 8 volt, the batteries are listed at 2s 3d to 16s 5d. *Mallory Batteries, Rainham Rd South, Dagenham, Essex.*

Four-way bedside outlet

SPECIALLY designed to meet the need for a multi-plug bedside adaptor, Nettle have produced a unit which provides four 5 amp connections from a 15 or 13 amp socket-outlet. Fully fused and shuttered, it is supplied complete with four flat two-pin plugs, all to be inserted in the one vertical face of the adaptor, providing convenient connections for lamp, clock, radio and electric blanket. The 13 amp model is priced 14s 11d and the 15 amp 16s 11d. They are available in white at 2s extra. These prices include the four white plugs, which may be obtained separately if desired. *Nettle Accessories Ltd., Warren St, Stockport.*



The 15 amp bedside adaptor, 16s 11d complete

High-power torch

A NEW Exide torch, "Searchlight" takes three dry batteries and throws a 500 ft beam of light. It has a plastic lens and pre-focus bulb. An opaque polythene ring in red encloses the lens, giving a 2½ in. diameter head. Drydex type T20 or (leakproof) T21 batteries, 7d or 10d each, respectively, are loaded through the base. The torch itself, Exide 3CP 20 A, is priced 14s 3d including p.t. *Chloride Batteries, Swinton, Manchester.*

Rapid spit roasting

HIGH-SPEED cooking performance is claimed for the Grill King range of spit roasters. The three models comprising this range, "Automatic," "Automatic-Lux" and "Popular," are all the same size, accommodating two to three chickens and cooking them within half an hour. These units are not confined to spit roasting, however, and will fry, grill or toast.

"Automatic-Lux," the most expensive at £29 10s, is chromium plated throughout with a back wall of safety glass and, like the other "Automatic" model, incorporates a timer control clock, two control lights and push-button switches. "Automatic" and "Popular" are priced £27 10s and £21, respectively. Oven dimensions, 15½ in. long, 10½ in. deep and 9½ in. high. Each model is provided with a Pyrex dish and stand, and a warming pan. *Valentine Equipment, 185 Kings Rd, Reading, Berks.*

TRADE PUBLICATIONS

E.E.—Abridged valve data book from English Electric Valve Co., Chelmsford.

COMBINATION.—52-page book on patent crimped-on gland from Combination Metallic Packing Co. Ltd., Glasshouse St, St. Peters, Newcastle upon Tyne 6.

WELCOME TO TURNERS.—Brochure on activities and development of Turner Bros. Asbestos Co. Ltd., Rochdale, Lancs.

MORGANITE.—Brochure on carbon current collectors from The Morgan Crucible Co. Ltd., Battersea Church Rd, S.W.11.

POLYPENCO.—Leaflet on PTFE extrusions and mouldings from Polypenco Ltd., Tewin Rd, Welwyn Gdn City, Herts.

LUBROOK.—10-page brochure on oil retaining bearings in Lubrook and Ferrocite. Bound Brook Bearings Ltd.

MULLARD.—New guide to semiconductors. Mullard Ltd., Torrington Pl, W.C.1.

SILUMINITE.—Leaflet on electrical insulation paper. Also SINDANYO, incombustible board. Turners Asbestos Cement Co. Ltd., Trafford Pk, Manchester 17.

SERVOMEX.—Leaflet and price list of instruments and controls from Servomex Controls Ltd., Crowborough, Sussex.

SAX.—Brochure on call and alarm systems by Julius Sax and Co. Ltd., 24 Commerce Rd, Brentford, Middx.

LEL.—12-page booklet on h.v. fuses, Line Equipment, 32 Queen Victoria St, E.C.2.

PYE.—Latest edition of scientific instrument catalogue, 32 pages. W. G. Pye and Co. Ltd., Granta Wks, Cambridge.

I.R.C. Catalogue and price list of silicon diodes from International Rectifier Co. (G.B.) Ltd., Oxted, Surrey.

NIMOCAST.—36-page technical booklet on heat-resisting alloys. H. Wiggin and Co., Birmingham 16.

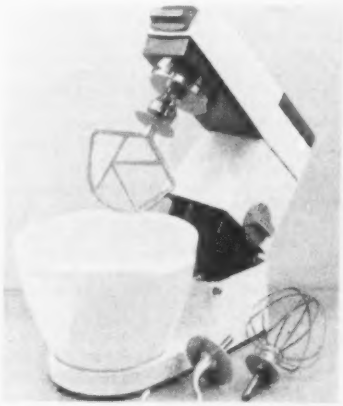
Colour-corrected tubes

A RANGE of colour-corrected fluorescent lamps, Philips Colour 34, available previously only in limited quantities in the UK, are now generally obtainable. They have two layers of phosphor coating which give a naturally blended light, deficient neither in red nor blue. The lamps are supplied in all normal ratings from 20 W 2 ft to 80 W 5 ft. They are no dearer than the other colours, the two models mentioned above costing 12s 4d and 15s 3d, respectively. *Philips Electrical, Shaftesbury Ave, W.C.2.*

Improved Kenwood mixer

A NEW lightweight mixer has appeared in the place of the Kenwood "Chef" food mixer, old model. This new kitchen appliance has certain components cast from a magnesium alloy which is claimed never to have been used before in this country for a domestic appliance.

Another innovation is a spring-assisted head release. Depression of a button at the base of the mixer frees the head, which can then be raised with finger pressure. Complete with heat resistant white glass bowl and grey plastic mixer, beater and dough-hook accessories, the "Chef" costs £27 6s including p.t. It operates on a.c. or d.c. supplies. *Kenwood Manufacturing Co., Old Woking, Surrey.*



The new Kenwood "Chef" is lighter, but remains at £27 6s.

Stelvetite-cased washer-spinner

A NEW washer-dryer with an outer casing of "Stelvetite," the "Gay Day," is to be introduced shortly. "Stelvetite," a plastic-coated steel, gives the cabinet a white tweed finish that is resistant to chemical and mechanical damage. This machine, a two-tub model for agitator washing and spin drying, has a 3 kW immersion heater and pump, and a capacity of 6 lb dry clothes. The spinner is fitted with a safety device which cuts the motor and arrests rotation if the top is lifted during operation. Working in direct conjunction with the 100 W spinner motor, the pump removes water immediately it is extracted from the clothes, vacating it through a swivelling arm which also serves the washing tub. This arm can be raised or lowered to empty water in sink or back into the washpan. Neon lights in the control panel indicate which circuits are in action. The "Gay Day" cabinet is trimmed with blue and grey plastic extrusions with gold embellishment. Dimensions: 32¼ in. long, 18⅜ in. wide and 31½ in. deep. It retails at £82 19s. *Zeta Domestics Ltd., Brighouse, Yorks.*

Hand-cutting and boring tools

TWO new tools for the professional man, a wall slotter and a hammer drill, are now available. The slotter consists of two 9 in. nylon-bonded abrasive wheels on a 1,900 W angle grinder of Swiss design and grooves brickwork to a depth of 1½ in. and to a width of about 1$\frac{3}{16}$ in. The wheels are within a semi-circular protective casing which is placed edge-on to the wall. Width and depth of cutting can be adjusted. This tool will cut Fletton brickwork at 12 ft per minute, a nylon filter over the intake protecting the motor from dust. The cutting discs, each of which give between 50 ft and 150 ft of cutting service, cost 13s 6d each. With other types of head the same machine will re-surface, de-rust steel work and sand most building surfaces. It costs £46 18s; delivery from stock.

The hammer drill belongs to the range of "Duax" two-speed drills. It is designed to penetrate wood, skirting, brick or concrete, using only one insert head; its slender shape allowing close work in corners. Speed may be switched from 1,300 r.p.m. to 500 r.p.m. whilst hammer blows at 13,000 or 7,500 impacts per minute are brought into operation. Special solid and hollow type tungsten-carbide drills will penetrate extremely hard stone up to a depth of 14 in. and a diameter of 2½ in. If the hammer head is removed, this same tool may be used as a ½ in. heavy-duty drill. Price is £39 5s, complete with hammer head. *Trend Industrial Equipment, N.W.10.*

Cabinet dryer's new fittings

MINOR modifications to the "Babylux" cabinet dryer have not altered its price of £9 19s 6d. The cabinet lid has now been provided with hand grips which not only facilitate lifting when the machine is hot, but allow the lid to be hung on the side of the cabinet whilst inserting or removing clothes. A rack now fitted halfway down the container may be used for airing. This dryer has a loading of 1,200 W. *Aerialite Ltd., Castle Works, Stalybridge.*

TRADE PUBLICATIONS

(continued)

HOLMES.—Leaflet describing Holmes' Retroflux bag filters. W. C. Holmes and Co., P.O. Box b7, Turnbridge, Huddersfield.

L.L.—16-page guide to industrial resins and glues. Leicester, Lovell and Co., N. Baddesley, Southampton.

WIGGIN.—32-page booklet on nickel alloys. Henry Wiggin and Co., Thames Hse, Millbank, S.W.1.

HUNT.—Catalogue C272, Hunts (Capacitors) Ltd., Vulcan Way, Croydon.

CAMBRIDGE.—Leaflet on Weston saturated type standard cells. Cambridge Instrument Co. Ltd., 13 Grosvenor Pl, S.W.1.

BULGIN.—164-page catalogue of electronic components. A. F. Bulgin and Co., Barking.

SEI.—20-page brochure on electromagnetic transducers. Salford Electrical Instruments, Peel Wks, Silk St, Salford 3.

DCP.—Pamphlet on smut elimination. Dust Control Processes, Clarence St, Kingston upon Thames.

BELCO.—Pamphlet on water softeners. Head Wrightson Processes, 20 Old St, E.C.1.

PACE.—12-page brochure describing the TR-10 analog computer. Electronics Assoc. Inc., New Jersey.

QUICK FIX.—Brochure-price list of press-in terminals. D.J. Equipment, Hersham.

THORLUX.—88-page booklet-price list on industrial lighting equipment (1067). F. W. Thorpe Ltd., Weby Rd, Birmingham 28.

BLACO.—Price list 18 on conduit fittings. F. C. Blackwell and Co., Liverpool 23.

ICI.—Two brochures describing properties and fabrication of Titanium. Imperial Chemical Industries Ltd., Millbank, S.W.1.

INSU-PAK.—Leaflet on perimeter insulation for underfloor heating systems. Tretol Ltd., The Hyde, N.W.9.

PHILIPS.—Pamphlet on Bi-Pin fluorescent fittings. Philips Electrical, Shaftesbury Ave.

PC.—16-page booklet-price list on floor and skirting cable trunking. The Power Centre Co., Lloyd St, Wednesbury, Staffs.

GOBLIN.—Large display poster on domestic appliances. Goblin (BVC), Leatherhead.

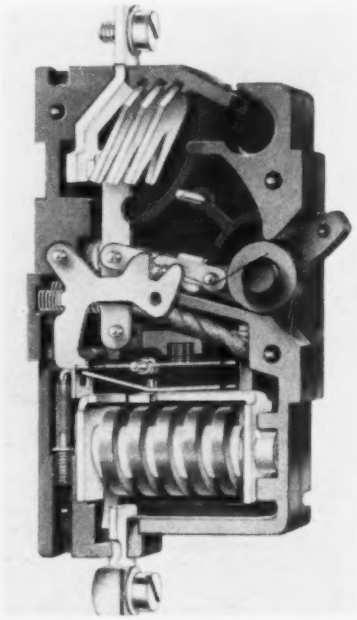
SELENIUM.—Technical pamphlet on rectifier stacks. International Rectifier Co., Hurst Green, Oxted, Surrey.

EDMUNDSONS.—1960 catalogue of lighting fittings. Edmundsons Electrical Wholesalers, 240 Ferndale Rd, S.W.9.

HANDSLITE.—1960 catalogue of lighting fittings. Harris and Sheldon Ltd., Ryder St, Birmingham 4.

COMPACT M.C.B.

LATEST addition to the range of available miniature circuit-breakers is the C-50 in the J. A. Crabtree range. This is suitable for use in the all-insulated consumer's unit which the firm displayed at the Electrical Engineers' Exhibition. A feature of the breaker is its compact size. Available single-pole in ratings from 2½ to 50 amp, at 17s 4d list price, the breaker is just under 1 in. wide and about 4 in. high by 2¼ in. deep.



Construction of C50 miniature circuit-breaker

The illustration shows the construction of the m.c.b. It incorporates an electro-mechanically operated tripping mechanism, with all ratings set to trip on a sustained overload of 30%. An essential feature is a built-in inverse time-current device which holds off transient overloads from causing tripping, while ensuring instantaneous operation under heavy overload or short-circuit fault conditions.

The operating handle of the breaker controls the moving contact through a collapsible over-centre toggle mechanism. There is positive control in both on and off positions, so that the breaker can always be manually opened and closed. As the breaker closes, the main spring imparts a high contact force which reduces danger of welding-in of contacts, as well as keeping contact resistance low, with resultant low heat losses and freedom from danger of welding.

Proving tests on the breaker are claimed to have justified the issue of an interim breaking capacity certificate for 3,000 amp at 0·8 power factor, 250 V. After tests at this rating, the m.c.b's were found capable of carrying out their full duty.

The all-insulated consumers' unit which the C-50 m.c.b. fits is a moulded case in which line, neutral and earthing busbars are fixed to a metal backplate and secured to a hardwood mounting frame. A 60 amp a.c. double-pole isolating switch is provided and there is provision for six m.c.b's. As supplied, the units have two blanking-off plates to provide for installations where less than six ways are required.

PROBLEMS AND PRACTICE

We welcome contributions to this feature, those published will be paid for at our standard rates. There must be many problems encountered in day-to-day electrical work, or useful ideas or tools devised to make it easier; all make instructive reading.

Cable Labels

READERS faced with a problem of cable identification may be interested in the following method of labelling underground cables when installation time is limited. In a petroleum processing plant the main and control m.i.c.c. cables had to be installed in a sand-filled concrete trench. This ran under the pavement beside the process building and then across a factory road to a switch house outside the flameproof area. During the construction period only a very short time could be allowed for the road to be closed to traffic, the trench opened and the cables installed.

Each of the 175 cables had to have an identification label attached to it at 12 ft intervals and two groups of labels were necessary where the cables crossed the road. The necessary labels were not, however, available on the site when the cable trench was open across the road.

It was agreed in the specification for the installation that aluminium labels could be used in certain positions which included the cable trench. A quick visit was made to the nearest automatic label machine of the type found at railway stations. Here the required number of labels were stamped out with the cable identification reference.

Since the cables were in relatively dry sand, electrolytic action between the aluminium label and the copper sheath was considered to be negligible. However, as an extra precaution, each cable was painted with a quick drying enamel for a section where the label was to be attached. The labels from the automatic machine thus provided a quick and satisfactory answer to an urgent problem and allowed the job to be completed in the time allowed.—*R. Elliot-Taylor.*

Conduit Continuity

HAVING read with interest the article by W.E.W. under the above heading (3 March issue), I must agree that it does seem a good idea to earth long runs of conduit at intermediate points, provided that this additional earthing is efficient and comes within the limits laid down by the IEE, otherwise these points could give trouble. If sole reliance is left to the conduit for the earth continuity and faulty couplings, elbows, tees and other connections are presenting high resistances, then plans should be made to bring the resistance down to that required by IEE Regulations. Where there is difficulty in earthing, I would suggest that earth-leakage circuit-breakers are used.

Surely, however, more use these days could be made of p.v.c. tubing and p.v.c. covered cables. I think the time has come to recognise that, on a great number of installations, metal conduit is a waste of time and money. Now there is so much slap-dash work about, metal conduit can become dangerous, particularly if it is used for the earth continuity conductor. On metal conduit installations I have inspected, I have many times found lock nuts loose, paint between lock nuts and boxes, inadequate threading of conduit, resulting in loose connections, and badly cut threads, resulting from the use of worn-out dies.

These are faults of bad workmanship which can cause conduit installations to develop high-resistance joints. Readers may say that this type of work could be done only by the cheapjack contractor, but, believe me, I have seen this dangerous workmanship from some of the well-known firms.

A great deal of this sort of bad practice stems, in my opinion, from lack of experience of earthing and the dangers which inefficient earthing can present and also to lack of knowledge of IEE Regulations. Moreover, in the "hustle and bustle" of present-day contracting, it seems that insufficient time is given to do the job properly. It follows, I feel, that more attention should be given to these modern techniques of wiring.

There is no doubt that some readers, especially of the old school, will still want to stick to conduit, but we have now reached a stage where plastics materials can play an important part and are indeed doing so in other countries. The present situation may be likened to an earlier period when conduit itself began to take the place of capping and casing.—*A. Dearden.*

Static Surprise

AT a paper-converting factory where I am responsible for the electrical and electronic plant, static electricity can be a problem, particularly in hazardous areas. I have had to install numerous anti-static devices, from "angels' hairs" to h.v. static eliminators, and have encountered this phenomenon in a variety of unexpected places.

Some time ago the operator of a large printing machine reported receiving a shock when controlling the machine from a remote control station at the rewind end. This appeared impossible, as the installation in this area was in conduit and the machine well bonded to earth. However, my electrician went through the routine of testing the continuity and insulation; all was found in order and the machine was run.

The following day the machine operator reported he was still receiving shocks and refused to run the machine unless something was done. I went to great lengths to demonstrate that the push buttons were safe, even going so far as dousing them with water. Then he told me that a spark had jumped from his finger to the button when he received the shock.

This immediately pointed to static electricity and a little examination was enough to show what was happening. The operator was wearing a pair of new shoes with thick rubber soles which effectively insulated him from earth. When handling the paper, a charge was built up on him and discharged only when he came into contact with earth, which happened to be the control station. I convinced him of this by getting him to touch other earthed parts of the machine and people around him who were less well insulated. It was possible to obtain a spark of about 1½ in. long, and I found that he held the charge for 3 to 4 min. Cure was simple: a change to shoes of lower resistance put the machine back into production.—*E. J. Last.*

Hum Trouble

REFERRING to the contribution by W. Satchwill under the above heading (14 April issue), it should be borne in mind that, in looking for the cause of the nocturnal noise in the auto-transformer, any slight noise appears to be considerably amplified during the "still of the night."

It seems quite possible, moreover, that this nightly phenomenon was also a case of resonance. The closing of a door, or the movements which are necessary for locking-up could create a combination of circumstances for building up the transformer noise.

If, on the other hand, the noise was caused by magnetostriction, no amount of packing on resilient materials would have any effect. As is quite widely known, magnetostriction is an actual change in the physical dimensions of the steel laminations which is caused by the alternating magnetic field and results in both noise and vibration.—"*Elmer.*"

(An article on magnetostriction appears on p. 675.—ED.)

News of the Week

MAJOR REFRIGERATION EXHIBITION PLANNED

British and Foreign models to be shown

PLANS to hold Britain's first major refrigeration exhibition in London in 1962 were announced this week by the British Refrigeration Association. The exhibition will feature both British and foreign refrigerators and will be open to the public.

Although details have not yet been finalised, it seems likely that the exhibition will be held in the spring, at the beginning of the traditional refrigeration season, and will be big enough to justify staging at Earls Court or Olympia. It is envisaged as the first of a regular series of refrigeration exhibitions to be arranged not necessarily on an annual basis, but probably every two or three years.

The council of BRA has already appointed a committee to determine policy and supervise arrangements and, in particular, to appoint an organiser. The association states that it is open to receive inquiries from experienced professional exhibition organisers with London facilities in 1962.

Admin. claim goes back to Tribunal

THE pay claim for administrative and clerical workers in the electricity supply industry has been referred back to the special arbitration tribunal, who are now asked to implement their own award made last November. At last Friday's special meeting of the National Joint Council there was disagreement over the assessment of salary ranges applying in other industries and it was decided to ask the tribunal to name their own award. The latter had earlier recommended that the NJC should give full consideration to the claim.

Grundig in N. Ireland

THE Grundig group of Western Germany is to set up a factory near Belfast, Northern Ireland, for the production of electronic impulse equipment and control gear. At present under construction on the Dunmurry industrial estate, the new factory is expected to employ over 1,000 people.

Molony Commitee Calls for Safety Compulsion

STATUTORY powers for a Minister to prohibit by regulations the selling or hire of goods which might be dangerous to the public have been recommended by the Molony Committee on Consumer Protection, in an interim report to the President of the Board of Trade. The Committee thinks that enforcement of such regulations should be by local authorities and they do not recommend a compulsory approvals testing scheme. Electrical appliances are discussed at length in the report, with particular mention of the need to prohibit imported appliances having misleadingly coloured flexibles, and of the possible danger from electric blankets not meeting BS requirements.

LAMP PRICE CUT?

NEWS of a further small cut in electric lamp prices seems imminent. This time coiled-coil lamps are believed to be involved and an early announcement is expected.

Pye-Sciaky link in Australia

A NEW Australian company, Sciaky Australia Pty. Ltd., has been formed jointly by Pye Ltd. and Sciaky Electric Welding Machines Ltd. for the manufacture of Sciaky resistance welding machines in a new £100,000 factory under construction at Fairfield, New South Wales. The factory will be in production at the end of May next.

Directors of the new company include Mr R. W. Ayers (UK) and Mr D. Sciaky (USA). The company has been formed in the twenty-fifth anniversary year of the British Sciaky concern.

Bendix on Merseyside

A NEW 350,000 sq ft factory costing £3¼ million is to be built by BMC on Merseyside and will be used by Fisher and Ludlow Ltd., a BMC subsidiary, for the manufacture of Bendix washing machines and refrigerators, in addition to other domestic products such as Fisherlow sinks.

The factory will be located on a 50-acre site in Kirkby, Lancs, and is due for completion in about 15 months. Structural work, worth £1¼ million, will be carried out by Holland & Hannen and Cubitts (North West) Ltd.

Light Fittings: Imports up 60%

DURING 1959 imports of electric light fittings into the UK reached a total of £999,843—an increase of nearly 60% on the 1958 figure of £682,139. More than half came from Western Germany, while the Netherlands, Spain, Italy and Denmark also supplied appreciable amounts.

These figures were announced last week by the Electric Light Fittings' Association, who point out that the £1 million import total is still only a fraction of the UK's export figure for light fittings. Last year the UK exported fittings to the value of £3,619,577, a slight gain on the previous year's total of £3,443,529. The top six export markets were: South Africa (£555,239); Eire (£284,171); Australia (£170,078); Kuwait (£161,500); Sweden (£157,350); New Zealand (£146,640).

An official of the association commented: "It is gratifying to find Sweden so high in the list this year, in spite of having a considerable industry of its own and stringent technical regulations, as it is one of the 'Outer Seven' whose tariffs against British products are likely to be progressively reduced. Exports to Sweden in 1958 were £98,452."

ACQUISITIONS

JOHN BROWN AND CO. LTD. and **Standard Telephones and Cables Ltd.** have acquired major interests in **Auto-Stackers Ltd.**, a company engaged in the "Autostacker" method of automatic parking of motor cars in multi-storey garages and the automatic stacking of commodities in warehouses. Auto-Stackers, who have received a contract to build the UK's first automatic multi-storey garage at Woolwich, have their offices at 20 Eastbourne Terr, W.2.

ULTRA ELECTRIC (HOLDINGS) LTD. have acquired the share capital of **Radio and Television Renters (Holdings) Ltd.**, a company in which they previously held a minority interest.

Pay claim deadlock

NO progress was made on the pay claim for manual workers in the electricity supply industry when officials of the five unions concerned met last week to consider the position. Apparently there was some suggestion of returning again to the chairman of the Electricity Council and of the CEGB, but no decision was reached.

The employers' side have already indicated their willingness to go to arbitration, but the unions' position has obviously been weakened by the fold-up of the unofficial strike threat. Another meeting of the NJIC is to take place next month, when the matter may again be raised.

Oldbury Public Inquiry

AT the end of the hearing at Thornbury at the public inquiry into proposals by the CEGB for the Oldbury-on-Severn nuclear power station, the two inspectors, Mr A. H. F. Linton and Mr C. D. Buchanan, inspected the rockshelf in the bed of the River Severn on which a reservoir will be built to provide cooling water for the power station.

The inquiry has been adjourned until 3 May, when the inspectors will visit Wallingford to see a model of the proposed station. During this visit, fishermen who may be affected by the project will be given an opportunity to comment before the inquiry is closed.

Consumer Protection Reviewed

IT is becoming more and more difficult to shop well, because of the increasing complexity of the goods on sale. That is the standpoint from which a broadsheet, *Consumer Protection and Enlightenment*, published by Political and Economic Planning, tackles a comprehensive though potted review of present practice in this field. Seals of approval and related test schemes are reviewed in some detail.

The gas board's appliance testing is thought the most successful attempt to deal with the problem of preventing shoddy goods from being sold; the equivalent electricity board's scheme is less successful because the showrooms do not dominate the retail selling in the same way as the gas showrooms. The review appears to think that the new scheme for an electrical approvals mark is planned by BEAMA alone and comments "this scheme, even if it is more than a gimmick, is likely to suffer the defects from the consumers' point of view of any scheme that starts at the manufacturing end."

BSI activities are not thought fully effective. PEP recognises that many manufacturers will not use the kite mark scheme because they think their goods are of a quality higher than the mark implies. Overall, it is not thought that British Standards are as good when standards of performance are involved as when they are concerned with safety.

The possibility of standards graded in respect of performance is discussed, but it is suggested that experience with such schemes in Sweden and the USA has indicated slow progress. Private seals of approval are judged of "varying, mostly indifferent usefulness to consumers." The value of brand names is rather disparaged.

The broadsheet considers protection of consumers by representation, in the consumers' councils of the nationalised boards, to be of little use.

The work of the Consumers' Advisory Council (*Shoppers' Guide*) and of Consumers' Association (*Which?*) is praised in the report. The first has a membership of about 50,000, with a much greater readership; the second a membership of 170,000 with 6% of the adult population estimated to read *Which?*

Consumers' Advisory Council is recognised to do much slow work in improving standards. The reports on comparative tests which both bodies publish are thought to be influencing an increasingly significant proportion of shoppers and retailers as well.

PEP feels that evidence now before the Molony Committee on consumer protection points to a general desire for a national body concentrating on matters affecting the consumer.

German firm to make U.S. nuclear designs

ONE of Germany's largest industrial concerns, the Gutehoffnungshutte Sterkrade A-G, has entered into a long-term licence agreement to manufacture in Germany the high temperature gas-cooled reactor designs produced by the US General Dynamics Corporation. The American concern has a contract for a 40 MW prototype gas-cooled nuclear reactor, which may lead to steam generation at 1,000°F, 1,450 lb/sq in. The German concern will also manufacture and sell the company's TRIGA research reactor.

SHIPPING ORDER

ONE hundred electric motors totalling over 4,000 h.p. have been supplied by Laurence, Scott and Electromotors Ltd. (LSE) for driving various auxiliaries on the new 27,500 ton turbine passenger liner *Empress of Canada*. Ten cargo winches, incorporating electrical braking and automatic control of maximum speed governed by weight of load, have also been supplied.

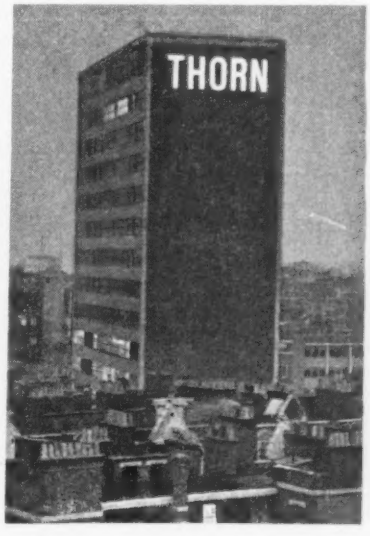
Dragon Reactor Site inaugurated

A SIMPLE ceremony marking the inauguration of the construction of the reactor experiment for the Dragon project took place yesterday at Winfrith, Dorset. The ceremony was performed by Dr S. Eklund, of Sweden, who is chairman of the Dragon Board of Management, on the site where the 20 MW high temperature gas-cooled experimental reactor will be built for the OEEC Dragon project.

The project is a joint undertaking by the UK, Austria, Denmark, Norway, Switzerland and the European Atomic Energy Community, Euratom (Belgium, France, Italy, Luxemburg, Netherlands, W. Germany), under an agreement, signed in Paris in March, 1959, which provides for a joint research and development project over a five-year period to design, construct and operate a high temperature gas cooled reactor experiment, using principles which have not yet been tried in practice.

Coal boiler for Ford's

A £1¼ million order for a coal-fired boiler for their Dagenham factory has been placed with Babcock and Wilcox Ltd. by the Ford Motor Co. Coal was chosen after full consideration of various other fuel sources, including atomic energy, for reasons of costing economy. Ford's coal consumption is 600,000 ton a year, delivered direct to the company's wharf at Dagenham from the Durham coalfield.



London's Highest Illuminated Sign ?

What is probably the highest illuminated sign in London has been installed on the west face of Thorn House, the Thorn Electrical headquarters building in Upper St. Martin's Lane, London. The name "Thorn" is displayed in 12 ft high letters of white enamelled sheet steel with triple tubing burning white. The top of the sign is approximately 180 ft above ground level. Manufacture and erection was by Pierce Signs Ltd.

This 20-ton electromagnetic transductor, believed to be the biggest of its kind in the world, has been made by Gresham Transformers for Westinghouse to control a rectifier output current of 12,000A. Value of the order is £17,500. The unit is here seen leaving the Gresham works

Component production: one million an hour

ONE million electronic components are being turned out in British factories each hour of the working week, according to the annual report of the Radio and Electronic Component Manufacturers' Federation. Production in 1959 was 2,400 million components, valued at £120 million—a rise of 20% over 1958, and the steepest annual rise since 1955.

The main increase was among components for radio and television receivers (43% of total), but more than 30% in addition went to manufacturers of capital goods and 14·6% were exported directly. Value of direct component exports was £11 million, an increase of 13½% on the year before.

Total production of radio and electronic components and equipment, including audio and valves, in 1959 was valued at £350 million, compared with £299 million in 1958. Exports totalled £53½ million, a gain of 17½% on the previous year.

The report expressed the Federation's concern at the rapidly growing imports of foreign radio and electronic products—mostly from the Netherlands, West Germany and the USA—which are rising at three times the rate of exports.

Discussing the radio and electronics industry as a whole, the Federation suggests that the time has now come when the electronics group of industries should have a separate Industrial Classification to enable more figures to be produced.

A.E.I. gain Safety Trophy

THE Sir George Earle Trophy for industrial safety achievement has been awarded this year to AEI (Manchester) Ltd. In its citation the Royal Society for the Prevention of Accidents states that the award was made "in recognition of many years of outstandingly successful efforts to produce a safe place of work for its large number of employees through training . . . and by the meticulous guarding of hazardous plant and machinery, and in recognition of the generosity of the company in making its help and advice available to others in the interests of accident prevention."

The company's frequency rate for reportable accidents has shown a continuous downward trend. During the past 12 years it has fallen from 1·13 to 0·46.

The trophy will be presented to the company at the RSPA Conference to be held at Scarborough on 27 May.

Export Credits Insurance Cheaper

CHEAPER premiums for certain classes of engineering goods and extended cover on certain policies are among the new moves announced last week by the Export Credits Guarantee Department. The three-year limit on the "whole turnover" type of cover (used by exporters of small capital equipment and consumer goods) is to be extended to five years from 1 May next, as is the case with capital projects, which will assist manufacturers of engineering products whose export sales have to be sold on credit terms for periods longer than three years.

Last year ECGD insured a larger volume of exports, while the cumulative reserve increased correspondingly to cover increased liabilities for potential claims. Total business insured was £694 million, compared with £570 million in 1958. The percentage of total UK exports insured with ECGD rose from 16% in 1958 to 18·4% in 1959.

U.K.-Czech Trade

A NEW three-year trade agreement between the UK and Czechoslovakia, signed in Prague last week, provides for quota lists of UK exports worth some £5·3 million during 1960. Electrical equipment and machinery is included in a wide range of engineering, chemical and textile goods. The quota lists also provide for UK imports of Czech goods to the value of £7·3 million.

Sales rise in March

RETAIL sales in March rose 3% on the same month last year, according to the latest Board of Trade figures, reaching an index of 109 (1957=100). Although sales rose seasonally on February, the increase was less marked than a year earlier when Easter fell in March.

E.I.B.A. Emblem Contest

THE Electrical Industries' Benevolent Association is to hold a competition for a new design for their emblem, or an improved version of the existing one, for which the prize will be two tickets for the EIBA annual ball at Grosvenor Hse, W.1, on 11 Nov. next.

The emblem should be so designed that it can be as effectively produced on letterheads and small cards as on large posters. A reproduction of the present emblem, with details of the association's requirements, is available on application to EIBA, 10 Buckingham Palace Gdns, S.W.1. The competition is open to all.

OFFICIAL PUBLICATIONS

Interim Report of Committee on Consumer Protection. HMSO. 1s (see page 698).

B.S. 697. Rubber gloves for electrical purposes. 5s.

B.S. Code of Practice 327.201. Reception of sound and television broadcasting. 12s 6d.

Picture shows (above) the interior of STC's new mobile exhibition unit, and (right) an external view of the vehicle

To enable designers and engineers to see STC components and discuss their characteristics and applications, this new Standard Telephones and Cables exhibition unit visits users and prospective users on their own "home ground." The exhibition features a cross section of the wide STC range of valves, transistors, rectifiers, transformers, resistors, capacitors, etc.

Computer for Air Traffic Control

AN Apollo computer which is being constructed by Ferranti will be the first of its type ever to be used for air traffic control experiments in the UK when it goes into operation at the Scottish air traffic control centre at Redbrae, Prestwick, early next year.

The computer, which has taken two years to develop, will print out flight progress strips relating to each aircraft and provide prompt information on air traffic conditions. It will also carry out calculations to see whether aircraft are in conflict, and print details for the benefit of the controller who will continue to retain full responsibility for re-routing the aircraft.

Electrical Accidents Review

SOME typical causes of industrial accidents involving electrical equipment are again included in the Ministry of Labour publication *Accidents* for April, 1960. Included is an incident in which cable couplers for a portable tool had been modified, so that there was no effective grip on the flexibles where they entered the equipment. In the particular case concerned, description of the effect of omitting the cord grip device was to permit entry of water which shorted the internal connections.

The official comment is that accidents caused by defective plug connections and flexible cables form a high proportion of electrical accidents, and the provision of a sound and effective cord grip could be one of the greatest factors in preventing them.

Another warning concerns connections to combined switches and fuses. Factory Department inspectors consider that more care is required than is shown at present to ensure that connections to such apparatus are correct when new gear is installed.

An incident is quoted where incoming and outgoing cables to an isolating switch had been reversed, so that the exposed blades of the switch were left alive when the switch was open. An electrician was burnt as a result.

42-hour week in Cable Making

The working week in the cable-making industry is being further reduced from 42½ hours to 42 hours, with effect from 8 May, without loss of pay. The reduction from 44 hours to 42½ hours was made last January

Friction burns from washing machines

TWO cases of severe friction burns produced by electrically driven wringers on domestic washing machines were described in the *British Medical Journal* last week. Both concerned a child (a boy of 4 and a girl of 8½) whose hand and arm had been drawn up to the elbow between the rollers of a power wringer left running and unattended. In each instance the friction of the rotating rollers on the skin produced deep burns which had to be treated by excision and skin grafting.

Reviewing the cases, the surgeon concerned noted the increasing popularity of washing machines fitted with power wringers and stressed the necessity for a foolproof safety device. "Similar machines in a factory would have to be guarded," he pointed out, suggesting that a "dead man's handle" type of switch, which would cut out as soon as the person operating the machine left, might make the appliance safer. "It must be realised, however, that it is almost beyond the wit of man to defeat a determinedly inquisitive child."

He made no reference, however, to the obvious advantage of the spin dryer from the point of view of safety, nor to the rocketing popularity of dryers and washing machine dryer combinations which do not need or use a power wringer.

Industrial Safety Conference

THIS year's National Industrial Safety Conference, organised by the Royal Society for the Prevention of Accidents, is to be held in the Spa Concert Hall, Scarborough, from 27 to 29 May, and will be opened by the Rt Hon E. R. Heath, Minister of Labour. At the conference Mr R. H. Coates, divisional controller of the Southern Division of the CEGB, will present a paper on "The Specialist as Part of the Team."

Other papers will deal with "Noise in Relation to Industrial Safety," "With Care—A Chemical Approach," "The Relationship between the Safety Officer and the Engineer," "Industrial Safety and the Use of Ionising Radiations," and "Accident Prevention Progress—And How."

Safety appliances of all types will be on show at an exhibition centre in the Spa Café. Inquiries should be sent to the Industrial Safety Division of the RSPA, 75 Victoria St, S.W.1.

Fly Ash wrecks Bulldozer

AFTER a powerful bulldozer had been severely damaged in an attempt to demolish an experimental embankment consisting entirely of fly ash (containing nothing other than added water to an optimum of 22%), explosives had finally to be used to level the site.

The embankment had been built to simulate a typical road section in Bedford some 14 months ago. Fly ash has valuable cementitious properties and has been successfully used as a "fill" on A1 road improvement schemes.

OIL CONSUMPTION UP

OIL consumption in the UK rose by 17½% in 1959 as compared with the previous year, to reach a total of 36½ million tons (excluding bunkers for ships engaged in foreign trade), according to figures issued by the Petroleum Information Bureau.

Among petroleum products, fuel oil consumption (including that for public electricity generation) again showed the greatest increase, being one-third up on 1958 at nearly 14 million tons.

The total of gas, diesel and fuel oils supplied for electricity generation during 1959 was 4,215,391 tons (compared with 2,643,958 tons in 1958). Supplies for central heating in domestic and other premises totalled 2,375,629 tons (compared with 1,905,690 tons in 1958).

New Service Centre for Durham City

First building in Durham City to have electric floor warming is this new service centre of the North Eastern Electricity Board in North Road which was opened recently by the Mayor of Durham. Special interior lighting allows for variation of colour and intensity. The centre has a spacious demonstration theatre which can be used for film shows, lectures, etc. To the rear of the building is a substation

Common Market Consequences

THE consequences which would follow if the Hallstein proposals to accelerate the tariff reduction programme of the European Common Market were accepted by the six countries concerned were outlined in the House of Commons a few days ago by Mr Anthony Barber, Economic Secretary to the Treasury. Under the Hallstein plan, the Six would reduce their internal tariffs on 1 July next by 20% instead of 10%, which, following the 10% cut at the beginning of 1959, would make a total effective reduction of 30% in tariffs covering trade within the group.

On the same date, 1 July, the Six would also make their first move towards a common external tariff, which would mean that for imports outside the group the tariff would rise or fall by 30% of the difference between the basic levels of 1957 and the level of the eventual common tariff, which in turn would be reduced by 20% subject to reciprocity from third countries.

Under these arrangements Britain would gain some advantage in the French and Italian markets where the tariff level was higher, but the benefits so gained would not compensate for the losses sustained in Western Germany and the Benelux countries, where there would be a sharp increase in the external tariff. In 1959 4¼% of UK exports, worth £160 million, went to France and Italy, compared with 10%, worth more than £340 million, to Western Germany and Benelux.

The Hallstein acceleration would deprive the UK of the breathing space which would otherwise be provided up to 1 Jan., 1962—the date laid down originally in the Treaty of Rome for the first move towards a common external tariff by the Six. In those 18 months the Government believed that, given good will on both sides, the Six and the Seven could make much progress towards a permanent settlement of the European trade problem.

Meanwhile, assuming the original Treaty of Rome timetable is followed, the EFTA Seven proposed to extend on 1 July to the Six and all other member countries of GATT the tariff cuts which the Seven were due to make on that date, provided the Six were prepared to act on a reciprocal basis.

Mr Barber assured the House of the "solidarity" of the Seven, and stressed the opportunities which the EFTA market offered the UK. Although the population of the Seven was little more than half that of the Six, its combined national income was two-thirds and its combined imports and exports three-quarters. The annual import bill of the UK's partners in the EFTA was about £3,000 million a year; Britain's exports to them were at present only £250 million.

Cool Reception

The Common Market Commission was opposed to the EFTA's recent proposal that the 20% cuts in the internal tariffs of the Six and Seven should be mutually extended on a reciprocal basis. Prof Hallstein stated in an interview in Bonn last week. He also rejected the suggestion that a delayed introduction of the Common Market external tariff might provide a "breather" to settle the differences between the Six and the Seven.

Electric Train Washer

A NEW electrically driven carriage washing machine is to be used at the smaller cleaning depots in the Eastern Region of British Railways. Smaller than the standard washing equipment, and more economical in use, the machine consists of two pairs of vertical flails supported in a free-standing structure on either side of the track.

Four shafts are driven by a geared motor unit, each carrying about 300 strips of felt which revolve to wipe the coaches passing underneath, water being sprayed over them automatically. The plant, which is fully automatic, is push-button controlled. The drive motors are made by GEC.

£6m. Boiler Contract

A £6 million contract for two steam generating units for Blyth "B" power station, Northumberland, is expected to be awarded shortly to Clarke, Chapman and Co. The company states that it has been advised by the CEGB that it has been successful in its tender for the plant. Steam conditions are given as 2,350 klb/hr at 2,400 p.s.i. 1,055°F, which indicate that the associated turbo-generators will be around 350 MW each.

Dewrance Developments on Show

IN conjunction with their international sales conference being held this week, Dewrance and Co. Ltd. have arranged a small exhibition at their Great Dover St works (London S.E.1) of recent developments in pipeline valves and associated equipment. The exhibition continues next week for those working in this field who wish to take the opportunity of bringing themselves up to date with the firm's products.

Of particular interest are two displays of American equipment which Dewrance are now making in this country under licence. This includes the "Microsen" process control system developed by Robertshaw-Fulton Controls which makes use of the balanced-beam principle to produce an electrical signal in the range 0-5 mA. whose value corresponds to the variable under measurement. The signal may be used to operate indicating or recording instruments or as the input to a controller governing the position of valves or other control elements. They also show a range of Asco solenoid-operated valves developed by the Automatic Switch Co.

Standardisation in Derby

SOME 100 new substations and nearly 190 miles of new cables will be needed to standardise the power supply system in Derby. Mr Nevill Marsh, chairman of the East Midlands Electricity Board stated last week. The overall cost of the programme would be around £2 million and, provided the necessary substation sites could be found without undue difficulty, the programme would be completed in about eight years.

The changeover programme in Burton would require 45 new substations and take about six years, at an estimated cost of £530,000.

Bird's-eye view of Export Prospects

OUTLOOK for British exports generally since January, 1960, has improved in New Zealand and Spain, but prospects are not so favourable in Ceylon, Kenya, Malaya, Singapore and Portugal, according to the April issue of *GEC Export Guide*, published last week, which takes a bird's-eye prophetic view of export prospects throughout the world during the second quarter of the current year.

The recent pattern of UK export trade has shown rapid gains in North America and Europe, but to the Commonwealth and under-developed countries, which buy over half the total, it has been less buoyant. The *Guide* suggests that industry should concentrate more on under-developed countries, adding: "We are tending to send the wrong goods to the wrong places. We need to link our industrial research and development more closely with export promotion, so that instead of concentrating on 'finding the right overseas market for our goods,' we aim more at 'finding the goods which overseas markets are likely to want'—in other words, to give demand a logical priority in our thinking on exports."

Export prospects for electrical machinery and equipment generally are improving in Denmark, Rhodesia and Nyasaland, Ghana and Hong Kong, but declining in Argentina, France, New Zealand and Portugal. The trends in three major categories of electrical products are given in the box at right.

ELECTRICAL EXPORT OUTLOOK

Generating Sets, etc: *improving*—Australia, Belgium, Rhodesia and Nyasaland, Ghana, Hong Kong, Kenya, Portugal, Spain, Trinidad, South Africa, USSR, USA, West Germany; *declining*—Argentina, Ceylon, France, Italy, Jamaica, Malaya, Netherlands, New Zealand, Norway, Venezuela.

Transformers, Switchgear, etc.: *improving*—Argentina, Ceylon, Denmark, Rhodesia and Nyasaland, France, Ghana, Iran, Iraq, Kenya, Nigeria, Trinidad, USSR, West Germany; *declining* — Belgium, Canada, Finland, Eire, Jamaica, Malaya, Netherlands, New Zealand, Spain, South Africa.

Cables, Wires, etc.: *improving*—Rhodesia and Nyasaland, Ghana, Hong Kong, Kenya, Switzerland, USSR, USA, West Germany; *declining*—Argentina, Australia, Belgium, Canada, Finland, France, India, Iran, Iraq, Malaya, and Singapore, New Zealand, Nigeria, Norway, Portugal, Spain, and the Union of South Africa.

The Case for Coal

A 24-page illustrated booklet of the above title, printed in colour, is being distributed to industrialists, architects, local authorities and hospital managements by the National Coal Board. The booklet has as its theme the slogan "Progressive industry is going forward on coal," and sets out to show that Britain's indigenous fuel can be the economical answer to many industrialists' fuel needs, graphically outlining the most effective methods of using coal in various industrial and civil fields, and explaining how the Clean Air Act works.

The "Halcrow Bequest"

THE Institution of Civil Engineers announce the establishment of the "Halcrow Bequest," provided for in the will of the late Sir William Halcrow, president in 1946-47, who died in Oct., 1958. It will take the form of an annual premium of £50 to be awarded to the author of the best paper published by the Institution on specified subjects. These are: docks and harbours, tunnels, and hydro-electric power. The subjects will be changed in a three-year cycle. Only corporate members of the ICE are eligible for a premium.

INFRA-RED GRANDSTAND

CLAIMED to be the best heated, best lit grandstand in the USA, Maywood race track near Chicago uses 270 3,800 W quartz infra-red lamps made by US General Electric and installed in specially designed reflectors to give an even distribution of heat and light over the 4,600 capacity grandstand.

Sayings OF THE WEEK

"In this country . . . no incentive is given to the lay inventor and unless his enterprise and initiative is soon recognised officially the inventiveness of the British mind will be stifled." . . . A. W. RICHARDSON, vice-president, Institute of Patentees and Inventors, writing to *The Times*.

"All the nationalised industries . . . are obliged by law to maintain advisory councils whose purpose is to represent the consumers' point of view. . . . Meeting rarely, run on Civil Service lines, with no research staff of their own, with disinterested consumers in the minority and with little finance to draw attention to their existence, they are very imperfect servants of consumers." . . . From the P.E.P. broadsheet on *Consumer Protection and Enlightenment*.

"We will not increase the price of gas, because it is idiotic to increase the prices of goods you are not selling." . . . MR D. WELMAN, chairman, North Western Gas Board.

PRICES of cable metals and other materials

Figures quoted are the official prices ruling on Tuesday, April 26

	£ per ton	Weekly change £
COPPER, standard class A (settlement) ...	271	+5½
" (3 months)	249	+3¼
LEAD, refined pig, 99·97% purity (cash)	77½	−½
" (3 months)	76½	−¼
TIN, refined, min. 99·75% purity (settlement)	797	+9½
(3 months)	786	+1½
ALUMINIUM, ingots 99-99·5% ...	186	—
" wire bars (4×4×54")	193½	—
BRASS Strip 63/37	239½	+10½
SILVER (Troy oz)	79d	—

	£ per ton	Weekly change £
ZINC, virgin, min. 98% purity (cash)	93½	+1
" (3 months)	90½	+¼
RUBBER, per lb. No. 1, R.S.S. spot	36½d	+1½d
c.i.f. basis, ports, July	34½d	—
ARMOURING: Galv. Steel Wire (0·104 in.) ...	66½	—
Mild Steel Tape (0·04 × 1½ in.)	53*	—
NICKEL (home)	600	—
MERCURY (76 lb flask)	70½	—
AMERICAN PRICES: Copper, electrolytic (per lb) ...	33c	▲
Lead (New York)	12c	—

* *Tape Price, now an average, includes varnishing*

TRADE WITH EGYPT

U.K. MISSION REPORTS ON EXPORT PROSPECTS

THE United Arab Republic is anxious to speed up the slow resumption of trade relations with the UK as part of a long term plan to increase exports and industrialise Egypt and Syria, Mr H. G. Nelson, leader of the British Trade Mission which recently visited Cairo, stated at a Press conference in London last week. Mr Nelson (who is managing director of English Electric and industrial leader and vice-chairman of the Advisory Council on Middle East Trade) was summarising the salient points of the Mission's preliminary report on their discussions with Egyptian ministers and officials.

Unfortunately, the UK's favourable position before the Suez incident had now largely been lost to Western Germany, but there was no discrimination against British products, which, in fact, carried considerable prestige in the Middle East. The UAR's needs had changed, however; they were concentrating now on machinery and equipment for development and industrialisation, and were no longer importing a large range of less essential consumer and luxury goods.

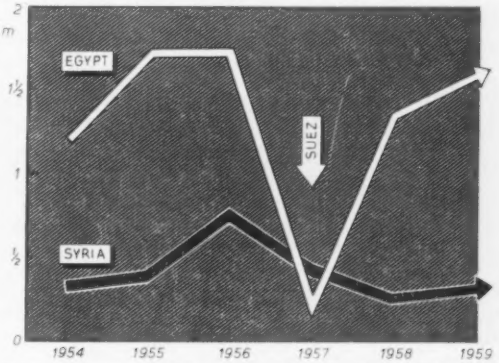


Diagram shows value of exports of electrical machinery, equipment and appliances from the UK to Egypt and Syria over the six years 1954 to 1959

The Mission learned that the UAR aimed to double the standard of living of its population in the next 10 years, and relied to a large extent on outside finance and extended credit. Soviet credits continued to figure prominently in UAR development planning.

Total UK exports to Egypt fell from £28·7 million in 1955 to £2·3 million in 1957, following the Suez crisis, rising to £13·8 million last year. The pattern of exports to Syria had been similar, but at a lower level. Britain's imports from the UAR were running at less than half the pre-Suez level.

On the other hand, UK exports of electrical machinery and equipment to Egypt have now largely recovered from the "Suez dip," having almost regained the 1955-56 level (see diagram above), although exports to Syria have remained static, with a slight upturn last year. In view of the UAR's industrial development programme, however, there would seem to be adequate scope for Britain to increase supplies of power generating plant, cables, electrical machinery, vehicles and railway stock, signalling equipment, radio, telegraphic and communications equipment, etc.

The Mission found that the UAR had been active in training apprentices for industry and this was a field in which the UK could participate. Meanwhile a UAR trade mission is to visit the UK to continue discussions.

Airlift for Linesmen

HELICOPTERS are being used experimentally by the South of Scotland Electricity Board and the North of Scotland Hydro-Electric Board to inspect 1,500 miles of overhead power lines. According to a spokesman of the S of S EB, a helicopter can cover an 80-mile stretch of line in one day, whereas by present methods it would take 20 men a week to do the same job.

The board's view is that though a helicopter is an expensive hire item (costing some £50 an hour), it might well prove to be an economical proposition.

Record-breaking Exhibition

ALL attendance figures at this year's Electrical Engineers' Exhibition broke previous records, the ASEE reports. The total attendance of 75,962 was 10% up on 1959. Overseas visitors numbered 886 from 76 countries—a 42% increase over the 1959 figure when 639 overseas visitors came from 71 countries.

Analysis shows that 189 visitors came from the EFTA area, 299 from the rest of Europe, 46 from America and Canada and 67 from Australia and New Zealand. The remainder, from the Far East, Near East, Central and South America, West Indies, etc., accounted for 285.

News in Brief

The rateable value of the nuclear power station to be built at Sizewell, Suffolk, has been fixed at £150,000. East Suffolk Standing Joint Committee has decided not to ask the CEGB, which will pay the rates, for any further contribution towards expenses.

The title of the Association of Engineering and Shipbuilding Draughtsmen is being changed to the Draughtsmen's and Allied Technicians' Association.

Engineers of the North of Scotland Hydro-Electric Board have carried out a survey of the island of Jura. About 200 people live on the island.

HM the Queen has approved the foundation of a Chair of Electrical Engineering at Edinburgh University.

The Imperial College of Science and Technology has published a booklet on their post-graduate course in nuclear power.

The 1960-61 list of members of the Electrical Wholesalers' Federation has just been published, price 1s.

A Northern Ireland Centre of the ASEE has been formed in Belfast. Mr L. F. Kirk is the local secretary.

Company Activities

Aberdare Holdings Ltd.

Sales by the cable subsidiary during the year were considerably below those of the previous year, and with very severe competition, the contribution of the cable company towards the group profits fell sharply. Although there has been a slight improvement recently Sir

Year to 31 Oct.	£ Trading Profit	£ Net Profit	% on Ord.		Ord. Price	
			Earned	Paid	High	Low
1955	694,717	294,825	39	17½	14/8	11/-
1956	660,260	248,423	33	17½	13/10	9/3
1957	688,323	259,264	35	17½	12/9	9/9
1958	755,720	290,838	39	17½	15/10	9/7
1959	777,687	333,818	42	17½	19/6	15/4

John Pascoe, the chairman, warns that the price level is still unremunerative. Fortunately the cable business is only about one-third of the group's total turnover, and South Wales Switchgear is getting increasing business with a very satisfactory amount for export.

Associated Electrical Industries Ltd.

The order book in 1959 amounted to £182,282,000—slightly above that of the previous year, Lord Chandos, the chairman, told shareholders last Thursday. Export conditions were difficult, but the company's exports were maintained at about 30% of total business. Four sections of the business gave trouble last year—cables, telecommunications, lamps and lighting and nuclear power stations. In cables, price cutting to below cost resulted in an adverse difference of £1,400,000 in the trading results, but there had been a recent movement to raise prices, which he described as self-discipline. By concentration into four plants instead of six, AEI would be able to produce cables of quality as cheaply as any company in the country, he said. Marginal profits were expected this year and, after completion of the rationalisation before the beginning of 1961, the strong position should provide adequate profit on the capital invested. In telecommunications the turn round from profits to losses had been £722,000, but there were encouraging pointers for the future and a modest profit should be secured this year. Lamp turnover increased substantially in 1959 in spite of price reductions and following vigorous measures to reduce costs and further rationalisation a steady improvement was expected. In nuclear power development, £750,000 had been set aside for probable losses, in addition to the £600,000 contributed towards the running expenses of AEI/John Thompson Nuclear Energy Co. The better trading parts included the Construction (Cables and Lines) Division, the Motor and Control Gear Division, and the Heavy Plant Division, which now had a very healthy order book. The Switchgear Division had a very prosperous year, while the Turbine Generator Division booked orders for over 2,000 MW of generating capacity, apart from two 300 MW sets for Canada confirmed in January. With the boom in domestic appliances, Hotpoint had a very successful year, increasing its turnover. Output of refrigerators in 1959 was 50% up on 1958 and, by next month, output of refrigerators would be doubled—but total production was already sold. Altogether, Lord Chandos reported that the demand for the group's products had shown a notable increase and increased profits were anticipated on ordinary trading accounts.

Year to 31 Dec.	£ Trading Profit	£ Net Profit	% on Ord.		Ord. Price	
			Earned	Paid	High	Low
1955	17,077,584	7,863,376	56	15	97/6	61/3
1956	12,957,272	4,373,778	22	15	85/6	57/-
1957	13,286,246	4,333,139	22	15	73/-	47/-
1958	15,971,205	4,502,396	20	15	59/-	46/6
1959	16,972,609	4,346,974	16	15	69/-	53/7

Babcock and Wilcox

A sharp drop in profit for 1959 confirms Mr Lionel Fraser's earlier prediction. After all charges and debenture interest of £259,913 (*£238,758*) plus £208,510 (*£180,244*) investment income, the group profit dropped from £3,277,626 to £523,154. Dividend is cut by 4% to 9% with a final of 4½%.

Barton and Sons

This conduit firm is effectively raising the dividend by 5% to 17½% with a final of 12½%. Profit for 1959 is £1,044,315 (*£862,415*), and after charging taxation the net balance is £545,217 (*£444,189*).

Bulpitt (Swan Brand)

In the first months of 1960 the demand for the company's products remains at a very high level, and sales have shown a very satisfactory increase, the chairman, Commander the Hon. J. M. FitzRoy Newdegate, reports. But increasing costs have resulted in increasing the selling prices of the products. A substantial improvement in overseas business is hoped for this year. Production of the automatic dishwasher reached an economic stage at the end of 1959.

Curry's Ltd.

Dividend for the year to 30 Jan. last is effectively raised by 5% to 22½%, although the group net profit is only slightly up at £610,982 (*£567,926*) after taxation charge of £591,787 (*£623,724*).

Drayton Regulator and Instrument Co.

For 1959 the net profit is £143,320, compared with £118,993 for the previous year, after charging taxation at £138,633 (*£125,801*). A final dividend of 15% makes the total 22½% (*20%*).

Enfield Rolling Mills

The group have begun, so far, with an even better level of demand than in 1959 and Lord Verulam, the chairman, views the future with confidence. But he warns of monopolistic tendencies in the cable industry as the result of the RTP Act, and points out that the impact of the industry on export markets will

tend to be less, an inevitable consequence which will rejoice the hearts of competitors abroad.

Glenfield and Kennedy Holdings

Group profit for 1959 amounts to £558,885 (*£438,999*) and, after taxation, etc., the net profit is £326,773 (*£229,838*). A final dividend of 15% again makes the total distribution 20%.

Hopkinsons Ltd.

In a record year, the group net profit has jumped to £575,423 (*£456,598*), after charging taxation at £520,500 (*£457,250*). A final dividend of 15% raises the total distribution by 5% to 22½%.

Laurence Scott and Electromotors Ltd.

For 1959 the surplus on trading, etc., amounts to £1,122,674 compared with £1,015,480 for the previous year. After taxation the net profit is £415,322 (*£388,736*). Final dividend of 10% maintains the total at 15%, but this time on increased capital.

Mavor and Coulson Ltd.

After tax charge of £106,753 (*£314,479*) the net profit for the year ended 31 Dec. last fell to £162,032 compared with £365,435 for the previous year. But total distribution is maintained at 10½d per 10s share with a final dividend of 6d per share as capital as increased by the shares issued against the acquisition of Austin Hoy and Co. (Holdings).

Mexican Light and Power Co.

With unit sales in 1959 increasing by 7½%, net profit for the year is $5,109,011, as against $4,434,473 for 1958.

National Electrical Construction Co.

For 1959 the group net profit is £121,871 (*£104,876*) after taxation at £87,739 (*£87,397*). Dividend is raised 2½% to 20%.

Newman Industries

With net profit, after taxation, increased to £88,645 (*£43,876*) the dividend is raised 2½% to 12½%. Taxation charge this time is £53,500 (*£32,300*).

C. A. Parsons and Co.

Earlier proposals for a financial merger with A. Reyrolle and Co. have now been dropped. Mr F. W. Gardner, the chairman, reports an increase in the number of machines manufactured, many of larger capacity, the increase in total

Year to 31 Dec.	£ Trading Profit	£ Net Profit	% on Ord.		Ord. Price	
			Earned	Paid	High	Low
1955	4,304,512	2,002,670	96	10	5⅛	56/-
1956	4,775,222	2,340,420	45	8½*	69/2	41/-
1957	4,585,803	2,093,648	40	7½	71/6	43/6
1958	3,902,772	1,886,784	34	7½	55/10	43/-
1959	4,478,638	2,089,614	38	10	59/6	42/-

* Plus 50% capital bonus

MW of plant completed and dispatched being considerable. The works continues to be fully employed and this will be the case for some months to come, but some sections may be working below capacity for a part of next year, he warns. Output of transformers was also maintained, the volume of new orders being satisfactory.

ALWAYS an event in the electrical world, last week's annual statement by Lord Chandos, chairman of Associated Electrical Industries, Britain's biggest electrical combine, contained enough cautious optimism to brighten hopes a little after the somewhat dispiriting experiences of heavy electrical industry in 1959. AEI's own dull spots last year were listed as cables, telecommunications, lamps and lighting and nuclear power stations. Domestic appliance sales, on the other hand, boomed. Now, happily, demand for *all* the group's products has shown a notable increase and an increased profit of AEI's ordinary trading accounts are budgeted for in 1960.

This is a particularly happy state of affairs when it is remembered that only about 20% of the group's output goes to supply the "light" end of the electrical trade with the remaining 80% of production falling into the "heavy" category. Should the Chancellor decide to reimpose some form of credit "squeeze," therefore, it would appear that the increased demand for heavy electrical equipment is now gaining sufficient momentum to counter the injurious effects such a clamp down would have on the group's domestic appliance production.

Meanwhile, their Hotpoint subsidiary increased its turnover by no less than 54% in 1959 and increased its share of the market in washing machines. The output of refrigerators was 50% higher than in 1958 and by next month the 1959 output of refrigerators will have been doubled. Already, virtually the whole of the 1960 production has been sold. In addition, AEI is currently turning out about one million cathode ray tubes a year and over 14 million valves for radio and TV. Their plastics company has greatly expanded its order books and prospects are described as "excellent." Similarly, the order book for scientific instruments and components has grown considerably. A remaining dull spot, however, is the group's venture in Australia with E. K. Cole in the manufacture of TV sets and c.r.t.'s.

Something of a headache is still presented by the AEI/John Thompson venture on the Berkeley nuclear power station. It was known that an additional £750,000 was set aside in the last AEI accounts for losses on the project but it is still not clear whether this will represent the final allocation from trading profits. Lord Chandos spoke of the "hope that with what we have already put on one side, this will prove adequate."

Nor would he make any fuller reference to the AEI—Reyrolle deal whereby AEI is to acquire half of Reyrolle's 40% Ordinary shareholding in C. A. Parsons and Co. in return for a 1,525,000 block of AEI £1 Ordinary shares—a deal in the region of £4 million and which will give Reyrolle a 3½% stake in the AEI equity. Ostensibly, the arrangement is for "co-operative research" and it is not very likely, I think, that Lord Chandos will be much more illuminating on the subject next month when the extraordinary meeting will be held to increase AEI's capital. One can, however, recall Lord Chandos's words last year at this time that the trend in the electrical industry will be towards larger units. Last week he added that he sees the electrical industry as a "growth industry" during the next 10 years and reaffirmed that it is AEI policy to be engaged in the whole range of electrical apparatus. By 1970, therefore, we might see even a closer grouping of AEI, A. Reyrolle and Co. and C. A. Parsons and Co.—*From our City Correspondent.*

Radiation Ltd.

This group, which includes Parnall (Yate) and Jackson Stove, reports a jump in profits for 1959 to £2,822,624, compared with £1,020,912 for the previous year. After taxation charge of £1,398,092 (*£537,060*), the net balance is £1,424,532 (*£483,852*). Dividend is virtually doubled at 10% plus 2% bonus, against a total of 6% last time.

A. Reyrolle and Co. Ltd.

It is proposed to make a one-for-one scrip issue involving the capitalisation of £4,579,411 of reserves, and increasing the capital by £5 million to £11 million, but there is no intention at present of

Year to 31 Dec.	£ Trading Profit	£ Net Profit	% on Ord.		Ord. Price	
			Earned	Paid	High	Low
1955	3,909,469	1,979,710	111	16½	6⅜	88/9
1956	2,907,102	1,256,825	53	17½	5⅝	81/-
1957	3,198,165	1,353,086	50	17½	5⅛	70/6
1958	3,188,389	1,358,257	51	17½	98/-	73/6
1959	3,133,788	1,428,021	50	17½	98/6	84/-

issuing the excess shares. Because of severe competition there was a reduced input to the works, which is reflected in lower trading results. The value of orders secured in 1959 was below that of the previous year, but Mr H. H. Mullens, chairman, states that input for e.h.v. switchgear has improved considerably, including such plant for two main substations for the 275 kV programme in South of Scotland. The new research laboratories and new tool room have come into full operation, and an extension made to the short-circuit testing facilities at the high power testing station. Mr Mullens also urges an extension of the repayment period for capital goods for the newly independent countries.

Sturtevant Engineering Co.

For 1959 group profit is £273,840 (*£527,645*), but total dividend is again 15% tax free with a final of 12%.

Allen West and Co.

In addition to a final dividend of 7½% again making a total of 12½% for the year ended 31 Jan. last, there is a 1% golden jubilee bonus. After taxation, the group net profit is £408,168 (*£426,704*).

Dividend Declared

George H. Scholes. Interim 5% (*4%*).

COMMERCIAL INFORMATION

Contracts Open at Home . . .

Dates given are the final for receipt of tenders unless otherwise stated.

29 April—Armagh. Electrical installations in: (1) school; and (2) kitchen; on fixed-price basis in additions to Forkhill Voluntary Primary School.—See 21 April issue.

29 April—Edinburgh T.C. Electrical installation in Muirhouse Old People's Home. Applications to City Architect, City Chmbrs, by above date.

29 April—Glasgow Northern Hospitals. Supply of electrical fittings for year from 1 June, 1960. Applications to Secretary, Board of Management, 13 Woodside Pl, Glasgow C.3, by above date.

29 April—Helmsey R.D.C. Contract 2. Provision and erection of duplicate pumping plant each capable of handling 2,400 g.p.h. against a 330 ft head.—See 14 April issue.

29 April—Maidstone B.C. Electrical installations in 40 old people's bungalows, Scheme P.W.8 Park Wood.—See 21 April issue.

30 April—Dumbarton T.C. Applications for separate trade schedules for erection of 130 houses Leven/Clyde streets and 40 houses Townend Rd.—See 14 April issue.

2 May—Armagh. Electrical installation in new office building, Alexander Rd, for M. of Finance.—See 21 April issue.

2 May—Barking B.C. Supply and erection of 105 35 ft steel columns, lanterns and control equipment along A13.—Advertised 21 April issue.

2 May—Birmingham C.C. Electrical installations, as separate contracts, in tenants' rooms on following estates: Hillyfields, Pool Farm, Dawberry Rd and The Firs.—See 21 April issue.

2 May—Clyde Navigation Trust. Supply of (item 9) cables and (item 10) lamps for year from 1 July, 1960. Stores Superintendent, No. 1 Graving Dock, Glasgow S.W.1.

2 May—Easington R.D.C. Supply of (item 4) electrical materials for period to 31 March, 1961.—See 21 April issue.

2 May—Harrow B.C. Supply and installation of 1,150 60 W sodium and 50 2 x 40 W fluorescent lanterns, lamps and control gear.—See 21 April issue.

2 May—Lancs C.C. Rewiring Darwen Spring Bank County Secondary School. Applications to County Architect, P.O. Box 26, County Hall, Preston, by above date. Reference A/G.

2 May—Stockport T.C. Electrical installations in (Contract 48A) 76 dwellings and (Contract 48B) 67 dwellings at Brinnington.—See 21 April issue.

2 May—Swinton and Pendlebury B.C. (1) Provision of 93 25 ft steel columns, bracket arms, 140 W sodium lanterns and control gear: (2) dismantling 32 existing m.v. units and erection and wiring of 93 columns and lanterns for E. Lancs Rd.—See 21 April issue.

2 May—West Riding C.C. Rewiring work at: (contract 2) Castleford New Fryston J.M. and I. School: (contract 3) Conisbrough Denaby Main School: (contract 4) and fire alarm system at Snenborough Heaton Ave School: (contract 5) Southowram J.M. and I. School.—See 21 April issue.

2 May—Willenhall U.D.C. Provision and fixing of Group "B" 80 W mercury discharge lighting and erection only of Stanton 9A concrete columns.—See 7 April issue.

3 May—Clydebank T.C. Supply of concrete columns, lanterns, auxiliary gear and o/h cable for A82 Gt. Western Rd lighting.—See 21 April issue.

3 May—Enniskillen. Electrical installation, by registered contractors, in new voluntary school for boys, Derrin Rd.—See 31 March issue.

3 May—Lisburn U.D.C. Supply and commissioning complete of two 100 and one 150 g.p.m. sewage pumps driven by 400 V 3-ph. motors. Surveyor's Office, Town Hall.

4 May—Bingley U.D.C. Supply (except columns) and erection of 113 Class "B" lighting units on various roads.—See 14 April issue.

4 May—Cardiff C.C. Supply of (1) concrete lighting columns; (2) lanterns, lamps and control gear; (3) solar time switches for year.—See 14 April issue.

4 May—Castle Ward R.D.C. Provision and erection 43 200 W linear sodium units on 35 ft steel columns on A1, North Gosforth.—See 14 April issue.

4 May—Wandsworth T.C. Supply and erection of 2,600 steel and concrete columns plus ancillary gear for sodium discharge lighting.—Advertised 7 April issue.

5 May—Belfast T.C. (1) Modification of fire alarm bell system at Orangefield Boys' Secondary School; and (2) installation of fire alarms, bells and controller at Mountcollyer Secondary School. Education Architect's Dept., 40 Academy St, Belfast.

5 May—Coventry T.C. Supply of (8) lamps and accessories.—See 21 April issue.

5 May—Hebburn U.D.C. (2) Electrical installations in 40 maisonnettes in Station Rd area. Applications to Engineer and Surveyor, Council Offices, Argyle St, by above date.

5 May—Manchester T.C. (2) Provision of a five-ton o/h crane for Davyhulme Sewage Works extensions.—See 31 March issue.

5 May—Omagh U.D.C. Rewiring in m.i.c.s. cables, supply of switchgear and lighting fittings in auditorium, stage and dressing rooms of Town Hall.—See 21 April issue.

6 May—Dagenham B.C. Lighting and power installations in 102 dwellings, Limbourne Ave.—See 14 April issue.

6 May—Glasgow T.C. Electrical installations in Bridgeton and Shettleston libraries.—See 7 April issue.

6 May—Kirkcaldy T.C. Supply of (a) electrical goods; (b) fittings; (c) lighting columns; (d) lamps; (e) cables on Lighting Dept., Schedule 2.—See 21 April issue.

6 May—Longbenton U.D.C. Supply and erection of (a) 51 sodium vapour units on concrete columns along Gt. Lime Rd; (c) 53 sodium vapour units on either concrete columns or on existing Electricity Board poles.—See 21 April issue.

7 May—Co. Fermanagh. Electrical installation in new voluntary primary school, Corrardaghy. Details from Sean MacCann, Clones Rd, Monaghan. Deposit £3.

9 May—Antrim. Electrical installations in: (1) school; and (2) servery; at new voluntary primary school for boys, Avenue Rd, Ballycastle.—See 21 April issue.

9 May—Belfast. Rewiring of Shankill Rd Y.M.C.A. Details from Lewis, Baxter and Associates, 1 University St, Belfast. Deposit £2 2s.

10 May—Armagh C.C. Electrical installation in new Portadown College. Details from Consulting Engineers, McCandless and Barton, 6 Murray St, Belfast. Deposit £3 3s.

11 May—Leighton Buzzard U.D.C. Erection of 62 Group "A" Stanton columns complete with A.E.I. lanterns and control gear on A418. Removal of 40 Group "B" columns and re-erection with new A.E.I. lanterns on various roads. Engineer and Surveyor, North St. Deposit £2 2s.

11 May—Middleton B.C. Supply of equipment for conversion of 109 street lights from gas. Borough Engineer and Surveyor, Town Hall.

13 May—Sheffield T.C. Supply of one 3-ton single girder crane for 38 ft span at Blackburn Meadows Wks of Sewage Disposal Dept. Contract B.M.(R.S.)28. General Engineer and Manager, J. A. Edmondson, Sewage Disposal Dept., Wincobank, Sheffield 9.

13 May—Sunderland C.B. Electrical installation in Southmoor Technical School extensions. Borough Architect, Grange Hse, Stockton Rd.

14 May—Dungarvan U.D.C. Supply and installation of two 950 g.p.m. against a 197 ft head submersible pumps, including motors, switchgear, piping, etc., for water supply improvement scheme. Details from Consulting Engineer, E. G. Pettit, 7 South Mall, Cork. Deposit £10.

14 May—Edinburgh T.C. Readvertised tender: (2) Maintenance of telephones and bells systems for year. City Architect.

16 May—Omagh. Electrical installation in County Courthouse, Omagh, for M. of Finance. Room 103, Law Courts Bldg, Belfast.

18 May—Sligo Mental Hospital Board. Supply of electrical equipment: one 100 lb washing machine; one 8 cu ft hydro extractor; one 60 lb drying tumbler; one 300/32 lb ironing machine.—See 21 April issue.

Your Queries Answered

Readers are invited to make use of our free enquiry department which possesses wide resources, including an index of trade information with over 100,000 entries

A Selection from the 107 queries answered this week

"Whirlaway" garbage disposal unit—makers of? R.B.—W. and G. Sissons Ltd., St. Mary's Rd, Sheffield 2.

"Ariel" erasing machine—makers of? Y.E.B.—Hall Harding Ltd., Stourton Hse, Dacre St, S.W.1.

"Hamco" fires—address for spares? L.G.A.—Campion Products Ltd., 378 Malden Rd, Worcester Park, Surrey.

"Stanley" electric tools—address for? E.M.S.—Stanley Works (G.B.) Ltd., Rutland Rd, Sheffield 3.

"Tallescope" tower wagon for street lighting columns—makers of? M.A.N.W.E.B.—Access Equipment Ltd., Marylands Ave, Hemel Hempstead, Herts.

"Minimaid" vacuum cleaners—address for spares? T.E.—Bylock Electric Ltd., Spares and Service Dept., Cartersfield Rd, Waltham Abbey, Essex, will do their best to assist.

"Laundmaster" sonic washing aids—makers of? E.E.B.—Northold Engineering Ltd., Elizabeth Wks, Thorney La, Iver, Bucks.

"Frimatic" refrigerators—agents for? P.E.—Edmundsons Supply Corpn. Ltd., 240-250 Ferndale Rd, S.W.9.

ANSWER WANTED

"Levin" frozen food cabinets—agents for? L.E.C.

23 May—Cheltenham B.C. Bill 1: Supply of 69 85/140 W sodium, eight 400 W colour corrected mercury and 71 45/60 W sodium lanterns with ancillary gear. Bill 2: Supply and erection of 134 fluted steel columns together with fitting and wiring of lighting equipment. Borough Surveyor, G. Gould Marsland, Municipal Offices. Deposit £3 3s. —Advertised in this issue.

23 May—Co. Armagh. Electrical installation in new voluntary primary school at Aghacommon, Lurgan. Details from C. P. McNally, 143 Royal Ave, Belfast. Deposit £3 3s.

23 May—Huddersfield C.B. Electrical installation including underfloor heating in two blocks of 11-storey flats, Northgate/Southgate.—See 21 April issue.

No date stated—Burnley C.B. Supply of 140 W lamps, lanterns, transformers, condensers, 25 ft steel columns, time switches, underground and lighting cables. Street Lighting Superintendent, Daneshouse Rd.—Advertised in this issue.

No date stated—Liverpool. Applications invited for inclusion in approved list for engineers and electrical supplies.—See 21 April issue.

No date stated—Stanway P.C. Provision of 19 140 W Group "A" sodium lanterns on 25 ft concrete columns along A12.—Advertised 14 April.

. . . and Overseas

*Details of items marked * may be obtained on application to the Board of Trade, Lacon Hse, Theobalds Rd, W.C.1, quoting reference.*

4 May—India. 125 tons bare, solid h.d. h.c. copper conductor from 1 to 10 s.w.g. Director-General of Supplies and Disposals, Shahjahan Rd, New Delhi. B.o.T. (ESB/10182/60).*

11 May—Rhodesia and Nyasaland. Seven items l.v. cable from 7/·036 to ·5 sq in. Town Clerk, P.O. Box 91, Umtali. B.o.T. (ESB/10011/60).*

16 May—India. One 3 MW steam turbo-alternator set for Masuria Power Hse, Jodhpur. Specification: PC/Jodhpur/Turbo Set/111, fee Rs. 25 by money order of crossed Indian P.O. in favour of Administrative Officer, Rajasthan State Electricity Board, Power Hse, Jaipur, from Stores Purchase Officer, H. K. Beher, at above address.

16 May—Sudan. One million metres carrier quad trunk cable. Posts and Telegraphs Dept., Khartoum South. B.o.T. (ESB/10102/60).*

18 May—Iraq. Telephone equipment including lamps and cable. Ministry of Defence, Baghdad. B.o.T. (ESB/10015/60).*

18 May—Pakistan. Two 20 A dry disc rectifiers and control panels Bannu and Nawabshah trunk exchanges. Mr. F. Rizvi, Purchasing Co-ordinating Officer, Posts and Telegraphs, Pakistan Secretariat, Karachi. B.o.T. (ESB/10370/60).*

19 May—Belgian Congo. Telephone cable and accessories. Service des Approvisionnements du Ministire du Congo Belge et du Ruanda-Urundi, 1 rue de la Regence, Brussels. B.o.T. (ESB/10319/60).*

25 May—Iraq. Tender No. ORD/31. 100 small and 200 large air coolers and 100 refrigerators. Directorate of Contracts and Purchases, Ministry of Defence, Baghdad. B.o.T. (ESB/10019/60).*

26 May—Australia. 415 V load switching relays. Design Engineer, Electricity Trust of S.A., Hindmarsh Bldg, Grenfell St, Adelaide. B.o.T. (ESB/10364/60).*

9 June.—India. Fifteen 300/400 g.p.m. 300/250 ft head submersible pumping sets for Neyveli Lignite Corpn. Details from India Store Dept., Government Bldg, Bromyard Ave, W.3. B.o.T (ESB 9485/60/ICA).*

25 July—Australia. Ash and dust handling plants for two 200 MW boilers at Vales Point. Commercial Manager and Secretary, Electricity Commission of N.S.W., Box 5257, G.P.O., Sydney. B.o.T. (ESB/9499/60).*

CONTRACTS PLACED

Basingstoke. Provision of electrical services at Park Prewett Hospital for Wessex Hospital Board, R. F. Webb Ltd., £4,975. Recommended.

Dartford B.C. Supply and erection of 25 mercury lanterns on steel columns, Oakfields La, Abacus Eng. Ltd.

Manchester C.C. Electrical installation in Nicholls County Secondary School extensions, E. M. Evans and Sons Ltd. Recommended.

Sheffield Hospital Board. Provision of lift at Western Hospital, Doncaster. Gimson and Co. (Leicester) Ltd., £2,649. Wiring and a.c. changeover equipment at Harmston Hall, Grantham Electrical Eng. Co. £714. Recommended.

Wolverhampton T.C. Electrical installations in Vauxhalls redevelopment scheme dwellings, Midlands E.B., £27,517. Recommended.

Gazette Announcements

COMPANIES ACTS

S. and Y.B. Ltd. Mr R. C. Shelley, 62 Tottenham Court Rd, W.1, appointed liquidator as from 28 March.

Langton and Young Ltd. Meetings of creditors and contributories to be held at 40 St. Margaret's St, Rochester, Kent, on 3 May, at 11 and 11.30 a.m., respectively.

Hydran Products Ltd. Mr J. H. Wilson, Bucklersbury Hse, Bucklersbury, E.C.4, appointed liquidator as from 8 April.

Lamberts (Electrical) Ltd. and **Cowley (Electrical) Ltd.** Meetings of creditors to be held at Gt. Western Hotel, Station Rd, Reading, on 6 May, at 10 a.m., and 2.30 p.m., respectively.

Carlton Electrical Co. Ltd. Creditors to send details to liquidator: H. F. Rudd, Carlton Holdings Ltd., Sandal, Wakefield, by 9 May.

Savage Transformers Holdings Ltd. General meeting of members to be held at Nursteed Rd, Devizes, Wilts, on 21 May, at 12 noon, to receive the liquidator's report.

Hunt and Little Ltd. First meetings of creditors and contributories to be held at Room 401, Inveresk Hse, 346 Strand, W.C.2, on 3 May, at 2.30 and 3 p.m., respectively.

Modern Homes Domestic Appliances (Ilford) Ltd. First meetings of creditors and contributories to be held at Room 401, Inveresk Hse, 346 Strand, W.C.2, on 3 May, at 10.15 and 10.45 a.m., respectively.

Morbury Electricals Ltd. Dividend per £: 1s 01d, payable at Official Receiver's Office, County Court Bldgs, Westgate St, Cardiff, on 29 April.

Partnership Dissolved

Manchester. Partnership between A. Lewis and R. Dumbell, electrical retailers, carrying on business as L and D Electrics at 330 Ashton Old Rd, Openshaw, dissolved as from 1 April. All debts to be met by R. Dumbell who is carrying on the business.

BANKRUPTCY ACTS

First Meetings and Public Examinations

Carmarthen. W. H. Thomas, electrical contractor, carrying on business at 6 Blaenau Rd, Llandybie. First meeting: 12 noon, 29 April, at Official Receiver's Office, Britannic Bldgs, 103 Lammas St, Carmarthen; and public examination: 11 a.m., 10 June, at County Court Offices, 14 King St, Carmarthen.

Wakefield. J. J. Franey and E. L. Bailey, electrical dealers, carrying on business in co-partnership as Regent Electrical Co., at 77 Barnley Rd, South Elmsall. First meeting: 11 a.m., 29 April, at Official Receiver's Office, Pearl Chmbrs, East Parade, Leeds 1; and public examination: 10.30 a.m., 29 June, at Court Hse, Wood St, Wakefield.

Dividend

Plymouth. L. C. Sampson and E. C. Tubb, electrical and television dealers, carrying on business in co-partnership as Electro Radio Stores, at Fore St, Gunnislake. Dividend per £: 3s 4d, payable at 2 Serjeant's Inn, E.C.4, on 29 April.

TRADE MARKS

This information is extracted from the Official Journal by permission of the Controller.

Amboline. 794,526. Class 11. Lighting apparatus, etc. A.E.I. Lamp and Lighting Co. Ltd., 33 Grosvenor Pl, S.W.1.

Ax-cent. B795,513. Class 11. Fans, etc. Keith Blackman Ltd., Mill Mead Rd, N.17.

Cand-lite. B795,544. Lamps, etc., A.E.I. Lamp and Lighting Co. Ltd., 33 Grosvenor Pl, S.W.1.

Digicon. 793,684. Class 9. Apparatus, etc. De Havilland Propellers Ltd., Manor Rd, Hatfield, Herts.

Jak. B792,851. Class 11. Hot water installations, etc. B. and J. Plant, 509/515, Attercliffe Rd, Sheffield 9.

Nieldex. 790,527. Class 9. Apparatus, etc. A. C. Nielsen Co. Ltd., Nielsen Hse, London Rd, Headington, Oxford.

Nu-Aire. B794,357. Class 11. Extractor fans, etc. Tack Air Conditioning Ltd., Ozonair Hse, 1 to 5 Longmore St, S.W.1.

Philips. B788,065. Class 10. Heated blankets, etc. Philips Electrical Ltd., Century Hse, Shaftesbury Ave, W.C.2.

Revo uti-lite. 797,342. Class 11. Lighting fittings. Revo Electric Co. Ltd., Britannia Wks, Groveland Rd, Tividale, Tipton Staffs.

Teonex. 799,324. Class 9. Apparatus, etc. T.O. Supplies (Export) Ltd., 42 Tottenham St, W.1.

TRADE NOTES

Change of Address. Ransome and Marles Bearing Co. Ltd. have moved their Leicester area office to new and larger office and stores at De Montfort Hse, 223 Belgrave Gate, Leicester. The telephone numbers are unchanged.

Licence. Under a licence agreement negotiated with Bristol Aircraft Ltd., Haven Engineering Co. Ltd., of 29 Corsica St, Highbury, N.5, are to manufacture and market the Bristol thermionic valve mounting clip, which has been developed primarily for use in guided weapons test equipment.

New Branch. Simms Motor Units Ltd. have opened a new branch at 114-126 Westmoor St, S.E.7 (telephone Greenwich 6226), which replaces the premises at Blackheath.

Scottish Agency. Mr J. Fraser, for many years with Land, Speight and Co. Ltd., and latterly industrial sales manager for their associate company Elesco Electronics Ltd., has resigned to set up an independent agency. A new company under the title Fraser Electronics and Communications Ltd. has been formed, and will also have as a director Mr W. O. Buchanan, A.M.Brit.I.R.E. operating from 1103 Argyle St, Glasgow, to represent in Scotland, manufacturers of electrical and electronic equipment.

Selling Agents. Griffin and George Ltd. are selling agents in Gt. Britain, Australia, South Africa and Eire for the Deutsche Innen und Aussenhandel Elektrotechnik, and DIA Feinmechanik-optik and the DIA Kulturwaren, of East Germany.

BUSINESS PROSPECTS

Ascot. Imperial College of Science and Technology plan £30,000 Silwood Park laboratory.

Barking. Ardin and Brookes, 129 Mount St, W.1, architects for £150,000 East St shopping centre.

Bath. Gerrard, Taylor and Ptnrs, 4 Bridge St, architects for rebuilding hospital for rheumatic diseases.

Billingham-on-Tees U.D.C. 270 house-building programme planned. Surveyor.

Birmingham. H. W. Weedon and Ptnrs, 45 Calthorpe Rd, Edgbaston, architects for Stampings Alliance £45,000 workshops at Nechells.—Amalgamated Engineering Union, 22 Bennett's Hill, plan Suffolk St offices.

Bootle. Peter Marsh and Sons, Dundee Works, Canal Rd, plan Canal St factory extensions.

Bolton. Arndale Property Trust, Swan Arcade, Bradford, plan Grapes Hotel site office building.

Bournemouth. M of Aviation plan Air Traffic Control School at Hurn.

Bridgwater. General Hospital extensions planned.

Brighouse. British Monorail plan Wakefield Rd factory extensions.—Tufted Carpets plan Brooking Mill buildings/offices.

Bristol. Nuthalls (Caterers) plan £120,000 improvements to two hotels.—High St site leases granted to Bank of England and Norwich Union Insurance Societies.

Cardiff T.C. Tender: 50 Green Farm dwellings. Architect.

Carlisle T.C. W. B. Edwards and Ptnrs, 5 Claremont Bldgs, Newcastle, architects for central area development scheme.—C. B. Pearson and Son, 24 Loxford St, Manchester, architects for £600,000 civic centre scheme.—Scottish Motor Traction Co. plan workshops, etc., Petteril Bldgs.—Johnson and Wright, 13 Castle St, architects for County Garage Co. petrol-filling station. T.C. Tender: 22 Harraby Estate dwellings. Surveyor.

Chelmsford. Widford Estate site leases sought by Marconi's Internat. Marine Communication Co., B.I.C.C. Ltd., Horner and Wells, 145a Moulsham St, and Adam Pisch, 25 Viaduct Rd.

Chichester. J. G. Snelling Ltd., 1 Pound Farm Rd, contractor for £45,564 theatre unit, St. Richard's Hospital, for S.W. Met. Regional Hospital Bd.—Bridgewater and Sheppheard, 43 Bruton Pl, W.1, architects for £200,000 Bishop Otter Training College extensions.

Clare R.D.C. Tender: 18 houses, seven bungalows on three sites. Surveyor.

Coventry. Middlemores Ltd., 89 Little Park St, plan Torrington Ave factory/offices.—Tarver and Sidwell (Frozen Foods), Barras Heath Market offered Powell Rd site for cold store.

Croydon. Riches and Blythin, 16 Northumberland Ave, W.C.2., architects for Trojan Ltd. factory and offices rebuilding.

Cumberland C.C. £145,000 Newton Rigg Farm School development planned. Architect.

Daventry R.D.C. Tender: 8 Yelvertoft houses. Surveyor.

Dover B.C. Tender: 20 Aycliffe housing units. Borough Engineer.

Dundee. Wylie, Shanks and Underwood, 12 Clairmont Gdns, Glasgow, architects for National Cash Register Co. £300,000 factory block.

Edgware. Stroud and Nullis, 25 Ebury St, S.W.1, architects for Wellwood Estates shops/offices.

Eston. South Durham Steel and Iron Co. plan new Cargo Fleet Works beam mill.

Gateshead. Cussins Ltd, Gosforth, plan multi-storey High St offices.—T.C. plans 12-acre house development, Whitehouse La. Borough Engineer.—B.R. (N.E. Region), York, plan rebuilding Lobley Hill Rd bridge.

Glasgow. Coates Bros. and Co., New Arterial Rd, Orpington, plan Glasgow area factory.

Gravesend B.C. Tender: 28 dwellings on four sites. Borough Engineer.

Havant. T. Jolly, Grant and Kelsey, 26 Kent Rd, Southsea, architects for Stein Atkinson Vickers Hydraulics factory.

Heston. Wakeman, Trower and Ptnrs, 47 Bloomsbury Sq, W.C.1, quantity surveyors for £300,000 BEA training centre.

Huddersfield. Leeds Regional Hospital Bd plan £3½ million Green Lea Hospital.

Hull. £360,705 Training College planned.

Jarrow-on-Tyne. Pressed Steel Co., Cowley, Oxford, has £24 million three-year expansion programme.—B.T. plan 200,000 sq ft Simonside factory.

Larkhall. Wylie, Shanks and Underwood, 12 Clairmont Gdns, Glasgow, architects for £172,400 S. Simpson factory.

Leics. C.C. Tender: Loughborough College of Further Education. Architect.

London. A. Swift and Ptnrs, 21 Upper Grosvenor St, W.1, architects for Kirby St, E.C., warehouse.—Philip Hicks, 11 Duke St, Manchester Sq, W.1, architect for Norman Bros' Bankside printing works.—Mahon and Scears, 31 Harley St, W.1, quantity surveyors for Gt Ormond St Hospital.—W. W. and S. H. Fisk, 6a Bedford Sq, W.C.1, architects for £45,000 Consolidated Property Investments' High St, E.17, shops and maisonnettes.—Gotch and Ptnrs, 8 City Rd, E.C.1, architects for £175,000 National Employers' Mutual General Ins. Assoc. Bury St offices.—Victor Heal and Ptnrs, 14 Gray's Inn Sq, W.C.1, architects for Warwick La, E.C.4, office block.—Jenkins, Manning, Potter and Clamp, 19 The Green, Richmond, architects for School of Speech and Drama, Eton Ave, N.W.3, extensions.—Holcombe and Betts, 11 Portman St, W.1, architects for Abbot Birk and Co., Blackfriars Rd, extensions.—R. Seifert and Ptnrs, 28 Gt Ormond St, W.C.1, architects for Livonia St, W.1, office building.—Fitzroy Robinson and Ptnrs, 3 Gray's Inn Sq, W.C.1, architects for Petra Investments Ltd., St Martin's Pl area £320,000 office block.—S.W. Met. Hospital Board plan £292,050 St. Stephens Hospital development, stage two.

Maidstone B.C. Tender: 50 housing units, 28 flats and five bungalows, Shepway Farm and Parkwood estates. Borough Engineer.

Manchester T.C. Tender: Ringway Airport terminal buildings. Architect.

Margate. S.E. Metropolitan Regional Hospital Bd plan General Hospital maternity unit.

Matlock. North Derbyshire Engineering Co., plan Dale Rd North workshop.

Middlesbrough. Evans, Cartwright and Wollatt, Clarendon St, Nottingham, architects for £500,000 Dundas St development scheme for Met Railway Surplus Lands Co.

Monmouth. Corrugated Fittings, 6 Arlington St, W.1., plan factory.

N. Riding. School building programmes totalling £750,000. Richmond Girls' High School and Nunthorpe Modern School planned. Architect.—D. C. Hall, Duke St, St. James's, S.W.1, architect for Whitby West County Modern School, Scarborough Girls' Modern School, and Redcar Coatham Modern School.

Neath. Robert M. Douglas Ltd., Geol-y-Gors, Cwybwria, Swansea, contractors for £42,000 Aluminium Wire and Cable Co. factory.

Northwich. Manchester Regional Hospital Bd plan Victoria Hospital casualty department, and a new Hope Hospital maternity unit, Salford.

Norwich. Langdon and Every, 21 Russell Sq, W.C.1, quantity surveyors for £200,000 Kingswick Hall Training College extensions.

Oxford. Robert Matthew and Johnson-Marshall, 24 Park Sq East, N.W.1, architects for five-storey accommodation building and two-storey seminary, Logic La, for University College.—New Regent's Park College buildings planned, Pusey St.

Paisley. Costain Concrete Co., Newmains, Lanarks, contractors for stage 1, Rowan and Boden's Paisley site development.

Portsmouth. J. H. Day plan Fitzherbert Rd factory.

Preston. New Sharoe Green Hospital outpatients' department planned.

Richborough. Pfizers Ltd., 137 Sandgate Rd, Folkestone, plan 89-acre site development.

Romford. G. Shenstone and Ptnrs, 34 Bloomsbury Way, W.C.1, architects for £45,000 Lee, Cooper Ltd. factory.

Rugby. Hellberg and Harris, 13 Queen Victoria Rd, Coventry, architects for Associated Engineering proposed laboratories and offices.

Salford. Chidlow, Grafton St, Manchester 6, plan factory/canteen, etc., Whit La.

Scarborough. J. H. Napper, 133 Osborne Rd, Newcastle, architects for Girls' School.

Shenstone. Kodak plan £100,000 factory/offices.

Skipton. £123,163 extensions planned for Skipton General Hospital.

Stevenage Development Corpn. Tender: flats, shops, houses and factories schemes totalling £50,000.

Stockton-on-Tees. Benson, Yarm La, plan showroom/offices Brunswick St. J. G. L. Poulson, 54 Albert Rd, Middlesbrough, architect.

Sunderland. Alexander Rose Ltd, Elmwood St, Leeds, plan three-storey West Sunniside workshop.—B.C. plan reconstruction of Milton Hall School. Architect.

Surrey. £298,780 Mayday Hospital development, stage one, planned.—£147,660 central boiler house planned for Sutton and Cheam Hospital.

Sussex.—Managers of Goring School, Worthing, plan £50,000 five-class school.

Sutton Coldfield. Factory extensions planned on Reddicap Estate by S. and E. Repetition Ltd., and Alexander Controls.—F. E. Derricott plan Coleshill St factory extensions.

Tipton B.C. Tender: 36 flats in three blocks, 12 flats in three blocks and four houses, Aston St. Borough Architect.

Tottenham B.C. Tender: 18 Park La flats. Borough Engineer.

Uxbridge. P. Ingram and Co., 25 Catherine Pl, S.W.1, quantity surveyors for Bell Punch Co. extensions.

Walsall. S. E. Mokes and Co., 16 Freer St, plan Rollingmill St factory premises.—Geo. Mantle and Co., Whittimere St, plan to purchase 2,828 sq yd Alumwell estate site.

Warsop. £216,348 secondary modern school planned.

Warwick B.C. Tender: 18 houses, 15 flats, West End area. Architects: Jackson and Edmonds, 116 Colmore Row, Birmingham 3.

West Bromwich. Planned: Sections and Tube, Lyng La works extensions; Vowles Aluminium Co. Bank St die casting shop extensions; Churchfield Spring Co. Bank St workshops, etc., extensions; C. E. M. Fillmore, Waterloo Hse, 20 Waterloo St, Birmingham, architect for W. and J. Lawley Sams La brass department extensions.

West Hartlepool T.C. Hilda St and Ramsey St flats planned. Architect.

Wolverhampton B.C. Tender: 66 Pond La dwellings. Borough Engineer.

Worksop. £197,472 Sparken House School planned.

Worthing. Quick Release Terminals, 26 Norman Cres, Shoreham, Sussex, plan Northbrook Rd factory.—Symmons and Polden, 13 Liverpool Gdns, surveyors for R. W. Brenner's Tarring Rd industrial development. Fewster and Gamble, 5 Liverpool Gdns, architects for 10 two-storey Broadwater Rd West shops. District Property Investment Co.

Company Meeting

Newly Formed Product Divisions Add Greatly to Company's Strength and Competitive Power

—says Lord Chandos

DIFFICULT SPOTS TACKLED WITH VIGOUR

REVIEWING the financial results for the year 1959, Lord Chandos, Chairman, at the Annual General Meeting of Associated Electrical Industries Limited, said:

Our trading profit for the year, before taxation, but after deduction of other charges, including depreciation and a full year's interest on the 6% Debenture Stock, amounted to £11,098,000 compared with £11,069,000 in 1958.

The total capital employed in the business is £158,280,000. After deducting the amount of the Loan Capital and the Preference Capital, the equity capital employed in the Company is £127,495,000, against a nominal figure of £41,304,000. A 15% Ordinary Dividend, therefore, gives a return on the equity capital of 4·86%.

He continued: Looking at the electrical industry as a whole we see no reason to alter our view that during the next ten years it will be a growth industry, and that our share of that growth will increase with the increased capacity which we have now installed.

It is necessary to understand that your Directors are convinced that in this period of the century, the right policy is to be engaged in the manufacture of the whole range of electrical apparatus. This is true of your Group. We do make the whole range, from the smallest transistors to the largest generating plant, from domestic appliances to giant industrial machines. It is by having such a comprehensive range, we believe, that the huge sums which are necessary for research and development can be found, and only in this way is a company powerful enough to maintain and expand its position.

It is to be expected that in so wide a range, certain lines of our manufacture will be subdued, and others will be buoyant. Of course when the general market expands, we would expect to see all sections of the business in an active and profitable posture. This has not been true in 1959.

Lord Chandos then discussed those parts of their business which had been "giving trouble," namely, cables, telecommunications, lamps and lighting, and nuclear power stations. Commenting on cables, he said: We believe that our own position in cables is now a very strong one, and that by rationalisation of manufacture and its concentration into four plants, at Woolwich, Gravesend, Birtley and Lydbrook, instead of six, we shall be able to produce cables of quality as cheaply as any company in this country. In 1960 we expect to make marginal profits and after the rationalisation which will be complete before the beginning of 1961, our strong position should give us adequate profit on the capital invested.

Turning to telecommunications, Lord Chandos said one or two encouraging pointers could be seen for the future, and they were budgeting in 1960 for modest profits.

He next mentioned Lamps and Lighting and stated: We believe that the present inadequate return on our investment in Lamps and Lighting will now steadily improve to a satisfactory level.

Nuclear Power Partnership

On the general subject of nuclear power stations, Lord Chandos said: I warned you last year that we should make a loss upon the Berkeley Station, and I can only repeat that this still appears to be certain. He then referred to the provisions which had been made to provide for such losses, and added: The Central Electricity Generating Board decided that the amount of technical effort being put into the design of nuclear power stations was too great, against the programme which had been decided. Moreover, a fifth group had been added where there were originally only four. We thought, upon this advice, that it was wise to seek a combination with the Nuclear Power Plant Company, and found them ready to respond. We have therefore formed a partnership with them, called The Nuclear Power Group, under which we shall share expenses, and any contracts and orders which are obtained. The savings in overheads for both companies will be large, and the dawn of profits out of this business will be brought much nearer.

Lord Chandos then stated: These were the four difficult spots in 1959, and from what I have said, you will see that they have all been tackled with vigour: cables and lamps and lighting by rationalisation, telecommunications by cutting back the effort which we have devoted to them but not so far that we cannot cope with a revival of the business which we expect, and nuclear power by the combination which I have already described. These four are quite a significant part of our total business.

The Chairman then reviewed the other sections of the business, and, continued: The order book in 1959 amounted to £182,282,000. This is slightly higher than that of the previous year.

Export conditions were difficult during 1959, but, despite all the problems, our exports overseas are maintained at a high percentage—round about 30%—of our total business.

After reviewing overseas activities, Lord Chandos turned to matters of reorganisation, and said: As the shareholders know, on January 1 of this year the three main manufacturing companies were reorganised into Divisions. We have already enough experience of those Divisions which have been working to know that they are going to add greatly to the strength and competitive power of the Company. The main peak of our capital expenditure is now passed, and the prospects for 1960 would seem to show that our new capacity, even if it is not fully occupied, will be far more nearly so than it was in 1959. This is one of the principal reasons why the trading results for 1959 do not yet reflect the increased capacity which we have installed.

The Company's Liquid Position

The shareholders will notice that the Company has a satisfactory cash balance and is in a highly liquid position. Our cash balance amounts to £11,346,000: of the overdraft of £6,110,000, over £5,000,000 is against the Berkeley Power Station contract and is self-liquidating.

I must mention the recent arrangements for co-operative research which have been reached with A. Reyrolle and C. A. Parsons. This combination, which still leaves the three Companies competitive in their own fields, is designed—as the circular says—to cover both capital and current expenditure.

Lord Chandos concluded: The demand for all our products has shown a notable increase, and we are budgeting for increased profits on our ordinary trading accounts. A statement like this must be received with reserve, for although we know of no untoward events that are likely to occur, we can never be certain.

Associated Electrical Industries Limited AEI

MEETINGS TO NOTE

THURSDAY, 28 APRIL

I.E.E. "Radar Observations of Birds and 'Angels'," E. Eastwood. Savoy Pl. 5.30 p.m.

I.E.E. (Bristol Graduate and Student Section). "Some Applications of Magnetic Recording," H. M. Harrison. Kenyon Rd School, Wells. 7 p.m.

INSTITUTE OF FUEL (E. Midlands Section). A.G.M. and "Nuclear Power—The New Power Stations." G. T. Shepherd. Gas Showrooms Lecture Theatre, Nottingham. 6.15 p.m.

BRITISH INSTITUTION OF RADIO ENGINEERS. Discussion: "The Education and Training of the Professional Radio and Electronics Engineer." London School of Hygiene and Tropical Medicine, Keppel St, W.C.1. 6.30 p.m.

A.S.E.E. (S. London Branch). "Static Electricity in Industry," S. J. Emerson. Greyhound Hotel, High St, Croydon. 8 p.m.

FRIDAY, 29 APRIL

I.E.E. (S. Midlands Centre). Discussion: "The Generalised Analysis of Electrical Machines." College of Technology, Gosta Green. 6 p.m.

I.E.E. (N.E. Graduate and Student Section). A.G.M. Grey Hall, King's College, Newcastle. 6.30 p.m.

BRITISH INSTITUTION OF RADIO ENGINEERS (S. Midlands Section). "The Application of Semiconductor Devices in Power Supplies," D. D. Jones. N. Gloucestershire Technical College, Cheltenham. 7 p.m.

A.P.L.E. (S.W. Section). Visit to Hortsmann Gear Co. factory and introductory talk including reference to Production Planning and Work Study. Newbridge Rd, Bath. 2.15 p.m.

SATURDAY, 30 APRIL

I.E.E. (N. Midlands Graduate and Student Section). A.G.M. Leeds. 2.30 p.m.

MONDAY, 2 MAY

I.E.E. (Electronics and Communications Section). "Planning and Installation of the Sound Broadcasting H.Q. for the B.B.C's Overseas and European Services," F. Axon and O. H. Barron. Savoy Pl. 5.30 p.m.

I.E.E. (E. Anglian Sub-Centre). A.G.M. and "Fundamental Particles," Professor O. R. Frisch. Cavendish Laboratory, Cambridge. 6.30 p.m.

I.E.E. (S. Midlands Centre). "Radio Aspects of the International Geophysical Year," R. L. Smith-Rose. James Watt Memorial Institute, Birmingham. 6.30 p.m.

I.E.E. (London Graduate and Student Section). "Silicon Transistors—Their Manufacture and Fields of Application," J. T. Kendall. Assembly Hall, 3 (Tels.) Trng. Bn., R.E.M.E., Arborfield, Berks. 7 p.m.

INSTITUTE OF PHYSICS (Non-destructive Testing Group). Joint conference with Société Française de Metallurgie. Institution of Mechanical Engineers, Birdcage Walk, until 4 May.

A.S.E.E. (Bolton Branch). "Modern Installation Economics," K. Briars. Railway Hotel, Trinity St. 7.45 p.m.

A.S.E.E. (C. London Branch). "Gaseous Isotope Light Sources," H. L. Privett. White Hall Hotel, Bloomsbury Sq, W.C.1. 7.15 p.m.

A.S.E.E. (Essex Branch). "Ball and Roller Bearings," T. S. Nisbet. Angel Hotel, Ilford. 8 p.m.

TUESDAY, 3 MAY

I.E.E. (Measurement and Control Section). Discussion: "Teaching and Learning Machines." Savoy Pl. 5.30 p.m.

I.E.E. (N. Midlands Centre). A.G.M. Leeds and County Conservative Club, South Parade, Leeds 1. 6.30 p.m.

I.E.E. (N.W. Centre). A.G.M. and discussion: "How Safe are Domestic Electrical Appliances?" Engineers' Club, Manchester. 6.15 p.m.

I.E.E. (N. Ireland Centre). A.G.M. David Keir Bldg, Queen's University, Stranmillis Rd, Belfast. 6.30 p.m.

INSTITUTE OF PHYSICS. Annual dinner, Park La Hotel, London. 7 p.m.

ELECTRICAL ASSSOCIATION FOR WOMEN. Annual Conference at Folkestone until 5 May.

MECHANICAL HANDLING EXHIBITION at Earls Court until 13 May.

WEDNESDAY, 4 MAY

I.E.E. (N. Lancs Sub-Centre). A.G.M. and "Storage and Manipulation of Information in the Brain," R. L. Beutle. N.W.E.B. Demonstration Theatre, Friargate, Preston. 7.15 p.m.

I.E.E. (Bristol Graduate and Student Section). "The Bristol Siddeley 3 MW Turbo-generator," P. J. McMahon. N. Wilts College of Further Education, Cocklebury Rd, Chippenham. 7 p.m.

INSTITUTION OF MECHANICAL ENGINEERS. "The High-speed Heavy-duty Diesel Engine: Its Development, Design and Application," Dr Ekhart Schmidt. 1 Birdcage Walk, S.W.1. 6 p.m.

JUNIOR INSTITUTION OF ENGINEERS (Midland Section). Presidential address: "The Engineer's Role in Nuclear Power," Professor J. M. Kay. James Watt Memorial Institute, Gt. Charles St, Birmingham. 7 p.m.

INSTITUTION OF PLANT ENGINEERS (Southern Branch). "Insulation of Buildings," J. Churton. Polygon Hotel, Southampton. 7.30 p.m.

BRITISH INSTITUTION OF RADIO ENGINEERS (Computer Group). "Computer Controlled Television Displays for Flight Simulators," J. N. Naish. London School of Hygiene and Tropical Medicine, Keppel St, W.C.1. 6.30 p.m.

A.S.E.E. (Halifax Branch). "Lesser-known Regulations in the Thirteenth Edition of the I.E.E. Regulations," E. Smith. Crown Hotel, Horton St. 7.45 p.m.

A.S.E.E. (Preston Branch). "Lighting Techniques in Shops and Stores," J. O'Reilly. R.A.F.A. Club, East View. 7.30 p.m.

THURSDAY, 5 MAY

I.E.E. (Utilisation Section). "Safety in the Utilisation of Electricity," S. J. Emerson. Savoy Pl. 5.30 p.m.

I.E.E. (S.W. Sub-Centre). "The Application of Transistors to Line Communication Equipment," H. T. Prior, D. J. R. Chapman and A. A. M. Whitehead. Electric Hall, Torquay. 3 p.m.

I.E.S. (Nottingham Centre). A.G.M. Electricity Centre, Carrington St. 6 p.m.

FRIDAY, 6 MAY

I.E.E. (Medical Electronics Discussion Group). "Methods of Recording Measurements—Digital or Analogue." Savoy Pl. 5.30 p.m.

JUNIOR INSTITUTION OF ENGINEERS. "Standardisation of Some Electrical Measuring Instruments," F. W. L. Bosch. Pepys Hse, 14 Rochester Row, S.W.1. 7 p.m.

A.S.E.E. (Stoke and Crewe Branch). "Fire Alarms." Grand Hotel, Hanley. 7.30 p.m.

NEW COMPANIES

Extracted from the Register issued by Jordan and Sons Ltd., 116 Chancery La, W.C.2.

Engelhard Hanovia Ltd., 52 High Holborn, W.C.1. Manufacturers of and dealers in ultra-violet lamps, therapeutic infra-red lamps, heating appliances, etc. Nom. cap.: £100,000. Dirs.: not named. Subs.: Philip J. Mills and Donald W. Benjamin.

Industrial Audio Aids Ltd., 1/2 Gt. Winchester St, E.C.2. Manufacturers of and dealers in tape decks, tape recorders, etc. Nom. cap.: £5,000. Dir.: John E. Day.

Marsh and Crapper Ltd., 24 Norfolk Row, Sheffield 1. Electrical engineers and general electrical installation contractors, etc. Nom. cap.: £100. Permanent dirs.: John A. Marsh and Jeffrey N. Crapper.

Osmor (Windings) Ltd., 418 Brighton Rd, Croydon, Surrey. Manufacturers of and dealers in radio and electrical transformers, etc. Nom. cap.: £100. Dirs.: Dora Morgan and Alfred V. Lake.

S. W. Parks (Lewes) Ltd., 13 Prince Albert St, Brighton 1. Electrical engineers, etc. Nom. cap.: £1,000. Dirs.: Stanley W. Parks and Arthur T. Deacon.

A. B. Slade and Co. Ltd. To take over business of an electrical contractor carried on at Jordans, Bucks, by Anthony B. Slade, etc. Nom. cap.: £1,000. Dirs.: Anthony B. Slade and Annie Slade, The Seedlings, Jordans, Bucks; and David L. Pelton, Mulgrave, Latchmoor Grove, Gerrards Cross, Bucks.

PARKINSON COWAN LTD.

Mr. Hugh P. Barker's Review

THE Annual General Meeting of Parkinson Cowan Limited, was held on 25 April in London. The following is an extract from the statement by the Chairman, Mr Hugh P. Barker.

Our gross trading profit was £728,000 (£362,000 last year). Offsetting this we have had to increase our depreciation provision to £179,000 (£113,000 last year). The resulting profit before tax of £550,000 compares with £298,000 last year. Our tax bill is heavily increased at £269,000, which leaves a final net profit of £281,000 compared with £199,000 last year. Our earnings on Ordinary Stock calculated on a currently accepted basis show a return of 57%. Your Board proposes to pay a final dividend of 10% and a bonus of 2½% which, together with the 5% interim already paid, makes a total distribution of 17½% for the year costing £80,000. After allowing for Preference dividends already paid (£21,000) this leaves £180,000 to be distributed among the Reserves and Surpluses of the Group.

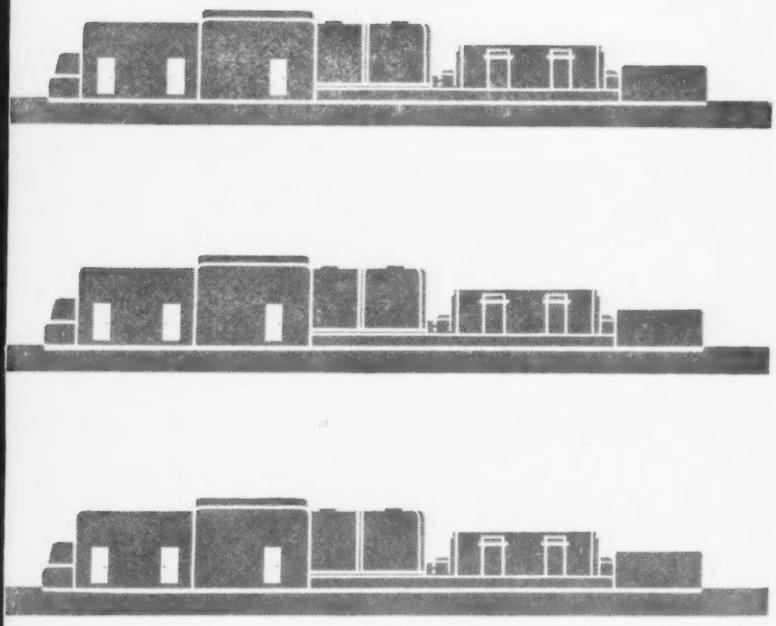
The high profits earned in 1959 were a direct result of the boom conditions in the domestic appliance market. We achieved a record output of cookers and increased our share of this market. The appliance business as a whole shows signs of tightening up, and I think it unlikely that 1960 will repeat the performance of 1959, though we expect to do well.

Our Meter and Instrument Divisions had a poor year, though towards the end business improved and is now running at a very satisfactory level. We have a first-class range of gas meters, which we are selling on a world-wide basis. Our business in liquid meters is also improving rapidly. Our Industrial Products Division has done well and is steadily expanding; the business of the Division is industrial heating, both for building, and for drying processes.

My views about the future of this Company have changed very little during these last years. We have a sound business, a good reputation and a catholic spread of interests. We have an excellent executive team, and many of our 3,000 employees have years of loyal service behind them. The pressure of commercial competition is nicely balanced by the pressure of opportunity. In this equilibrium your Directors hope to sustain the interests of our stockholders and employees alike. We expect to have a good year in 1960.

The Report and Accounts were adopted. *Copies of the Report and Accounts can be obtained on application to the Secretary at Terminal Hse, Grosvenor Gdns, London S.W.1.*

ONE...
TWO...
and now
THREE



WORKING SPECIFICATIONS FOR EACH SET

Continuous maximum rating Most economical rating	120 MW
Speed	3,000 r.p.m.
Generator voltage	13,800 volts
Power factor	0.8 lagging
Steam pressure at H.P. turbine stop valve	1,500 p.s.i.g.
Steam temperature at H.P. turbine stop valve	1,000°F
Steam pressure at inlet flange of reheat steam valve chests, at C.M.R.	375 p.s.i.a.
Steam temperature at inlet flange of reheat steam valve chests, at C.M.R.	1,000°F
Final feed temperature at C.M.R.	435°F
Absolute pressure at turbine exhaust flange at C.M.R.	1.5" Hg
Maximum cooling water temperature	85°F
Hydrogen pressure	30 p.s.i.g.

for Richborough

The order for the third 120MW turbo-alternator set for this new C.E.G.B. power station in Kent has recently been placed with Richardsons Westgarth (Hartlepool) Ltd. Work on the first two is already proceeding. Each set, built to Brown-Boveri design, consists of a 3-cylinder reheat turbine and a hydrogen-cooled alternator, generating at 13,800 volts. In addition to such turbo-alternators, Richardsons Westgarth make smaller industrial sets, gas turbines, water tube boilers, feed heaters, condensers, cooling water strainers and evaporators. In fact we can supply most of the main items for a power station, from an industrial unit, designed to run on by-product fuels or waste heat, to the largest public supply station.

R W G

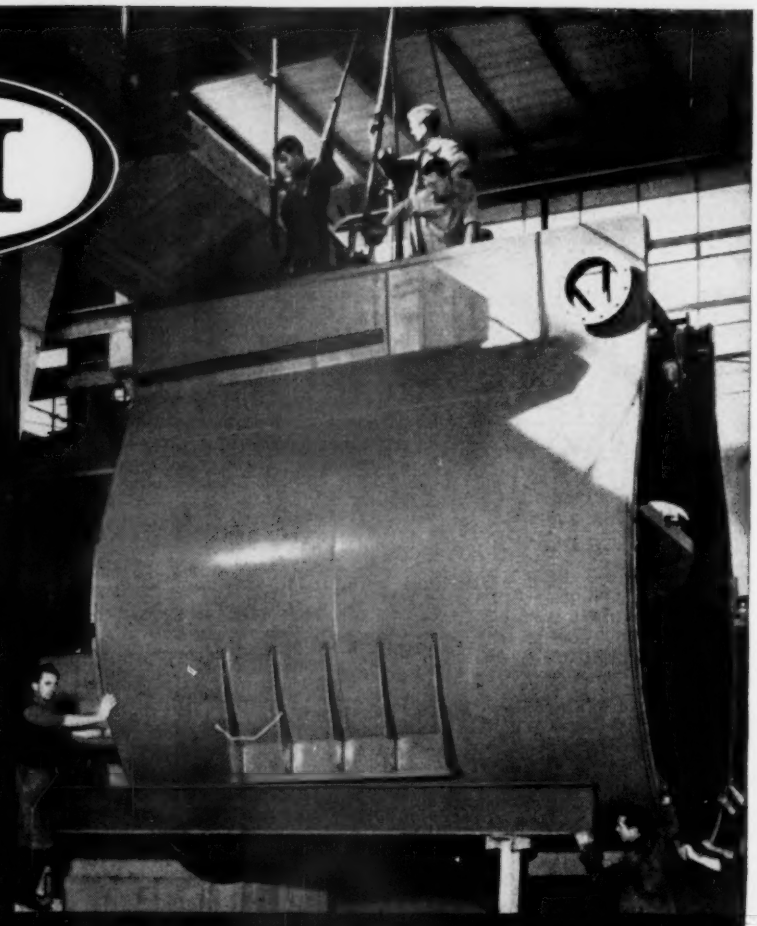
RICHARDSONS WESTGARTH (HARTLEPOOL) LTD.

A member of the RICHARDSONS WESTGARTH GROUP

HARTLEPOOL, CO. DURHAM AND 58 VICTORIA ST., LONDON, S.W.1,
59 MOSLEY ST., MANCHESTER, AND 75 BUCHANAN ST., GLASGOW. RW56

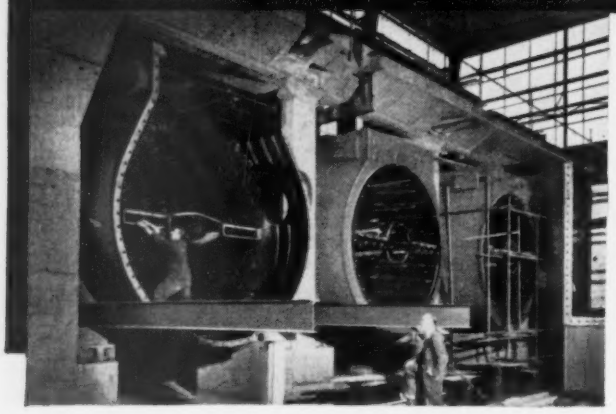
AEI

COMPLETE TURBINE-HOUSE EQUIPMENT



One unit of a three-shell surface condenser being placed in position at Berkeley, the commercial nuclear power station now under construction in Gloucestershire by the A.E.I.—John Thompson Nuclear Energy Company.

FOR BERKELEY NUCLEAR POWER STATION



A general view of three condenser shells in position at Berkeley.

The entire turbine-house heat exchange equipment for the new power station at Berkeley is being supplied by the A E I Turbine-Generator Division, and manufactured at their factory at Germiston Glasgow.

Four three-shell main condensers — one for each of the four 83 MW mixed-pressure steam turbine-generators also being supplied by A E I.

Two-stage feedwater heating equipment for each turbine-generator.

Two 'dumped' steam condensers to handle surplus steam generated when commissioning the reactors, or in the event of a sudden shut down.

Other equipment in manufacture includes the steam jet air ejectors, water/water heat exchangers for the generator cooling circuit and general gas circulator service, oil coolers and generator hydrogen cooler units.

Enquires to: AEI Turbine-Generator Division, Trafford Park, Manchester, 17 or to your local AEI office.

AEI

TURBINE-GENERATOR DIVISION

Associated Electrical Industries Limited

MANCHESTER & RUGBY, ENGLAND, GLASGOW, SCOTLAND, LARNE, NORTHERN IRELAND

B/A804

CLASSIFIED ADVERTISEMENTS

TENDERS INVITED

BOROUGH OF CHELTENHAM
Street Lighting 1960-61

TENDERS are invited for the supply and erection of Group "A" and Group "B" lighting installations in various streets of the Borough as follows:

Bill No. 1. For the supply only of 69 No. 85/140 watt Sodium lanterns, 8 No. 400 watt colour-corrected mercury lanterns, and 71 No. 45/60 watt sodium lanterns complete with all ancillary gear.

Bill No. 2. For the supply and erection of approximately 134 fluted steel columns together with the fitting and wiring of lighting equipment.

Specification and Bills of Quantities can be obtained from the undersigned on payment of a deposit of £3 3s which will be refunded on receipt of a bona fide tender not subsequently withdrawn, and the return of all documens.

Tenders, together with fully priced Bills of Quantities, are to be submitted in the envelope provided, to the Town Clerk, P.O. Box No. 12, Municipal Offices, Cheltenham, not later than noon on Monday, 23 May.

The Council does not bind itself to accept the lowest or any tender.

G. GOULD MARSLAND, M.B.E.,
Borough Surveyor.
(P 709)

COUNTY BOROUGH OF BURNLEY
Rossendale Road (Trunk Road) Re-lighting Scheme.

TENDERS are invited for the supply of the undermentioned items of sodium lighting equipment required in connection with the above:—

140 W Sodium lamps.
140 W Lanterns.
Transformers and Condensers.
25 ft Steel columns.
Electric Time Switches.
Underground cable.
Lighting cable.

Specification and form of tender may be obtained on application to the Street Lighting Superintendent, Street Lighting Department, Daneshouse Rd, Burnley.

C. V. THORNLEY,
Town Clerk.
(P 721)

APPOINTMENTS VACANT

SOUTH OF SCOTLAND ELECTRICITY BOARD
Fife Area

SECOND ASSISTANT DISTRICT ENGINEER
EASTERN DISTRICT

APPLICATIONS are invited from Engineers with a wide experience of general distribution and technical training up to Higher National Certificate standard for the above based on Cupar.

National Joint Board conditions. Salary: Class F. Grade 7, £910/£955 per annum. Post superannuable, subject to satisfactory evidence of health.

Applications, on standard form, obtainable from the Area Manager, S.S.E.B., East Port, Dunfermline, should be returned to him not later than 29 April, 1960. (P 695)

CENTRAL ELECTRICITY GENERATING BOARD
Southern Division

FOURTH ASSISTANT ENGINEER
TECHNICAL DEPARTMENT
Ref.: SEC/3.73/T.

APPLICANTS should have received a sound technical education and preference will be given to those possessing qualifications leading to corporate membership of a senior professional engineering institution.

The successful candidate will be required to deal particularly with special experimental investigations into technical problems.

Salary: N.J.B. AX/DX 8, £735/£935.

FOURTH ASSISTANT ENGINEER
TECHNICAL DEPARTMENT
Ref. SEC/3.77/T.

Applicants should have received a sound technical education and preference will be given to those possessing qualifications leading to corporate membership of a senior professional engineering institution.

The successful candidate will be required to deal particularly with the technical consideration of transmission problems .

Salary: N.J.B. AX/DX 8, £735/£935.

Special application forms obtainable only from Divisional Secretary, 111 High St, Portsmouth, should be returned by 10 May, 1960. Please indicate whether you wish to be considered for both of these vacancies and quote reference. (P 740)

TRINIDAD AND TOBAGO ELECTRICITY COMMISSION
Vacancy for a Shift Charge Engineer

THE Trinidad and Tobago Electricity Commission has a vacancy for a Shift Charge Engineer at the Penal Power Station.

Applicants should have experience in the operation of modern steam turbines, water tube boilers and diesel generators, and must have Graduate Membership of the I.E.E., or I.Mech.E., or Associate Membership of the I.Mar.E., or the Higher National Certificate in Electrical or Mechanical Engineering or Second Engineer's M.O.T. Diesel and Steam Certificate or Charge Certificate, Royal Navy.

The annual salary is £1,408, rising by three annual increments to £1,537. This salary includes a payment for Shift Work.

A partly furnished house will be provided at a rent of £10 8s 4d per month, plus a small extra charge for heavy furniture.

An outfit allowance of £60 is paid on arrival in Trinidad.

First Class passages to Trinidad will be provided for the successful applicant, his wife and children up to a maximum cost of four adult passages. First class leave passages to the United Kingdom will be provided every three years.

There is a Superannuation Scheme similar to the C.E.G.B. and Area Boards' Scheme.

Information on Trinidad can be obtained from the West India Committee, 40 Norfolk St, London W.C.2.

Applications giving full details of qualifications, age, experience, etc., together with copies of two recent testimonials should be sent by Air Mail to reach the General Manager, Trinidad and Tobago Electricity Commission, P.O. Box 121, Port of Spain, Trinidad, W.I., by 15 June, 1960. (P 729)

MIDLANDS ELECTRICITY BOARD
GENERAL ASSISTANT ENGINEER

REQUIRED in the Stafford District of the North Staffs Sub-Area:

Applicants should have had experience in the operation and maintenance of distribution systems. Technical qualifications desirable.

Salary £655/£700 per annum. (N.J.B. Grade F.12). Superannuable.

Apply by letter, stating age, education, experience, qualifications, present position and salary to Mr C. C. Pimble, Sub-Area Manager, Midlands Electricity Board, 234 Victoria Rd, Fenton, Stoke-on-Trent.

F. W. CATER,
Secretary.
(P 715)

SOUTH EASTERN ELECTRICITY BOARD
FIRST ASSISTANT DISTRICT ENGINEER
DORKING AND EPSOM

THE appointment will be made at N.J.B. Class F, Grade 5—Salary: £1,025 x £20—£1,085 with progression to Grade 4 (maximum salary £1,170) subject to satisfactory service. Superannuable. Applicants should preferably be Corporate Members of the I.E.E. They should have had responsible experience in planning, construction, operation and maintenance of both underground and overhead systems up to 33 kV in urban and rural areas. The ability to control staff and organise work is essential. Applications quoting ET and naming two referees on forms from District Manager, Seeboard, 56 South St, Dorking, by 11 May, 1960.

ASSISTANT DISTRICT ENGINEER
TWICKENHAM AND RICHMOND DISTRICT

Salary: £815 x £15—£860 per annum plus London Allowance under N.J.B. Class F, Grade 9. Superannuable. Applicants should have had a good general education, be technically trained up to Higher National Certificate standard and must have had practical experience in general distribution work on H.V. and L.V. systems. Ability to plan and prepare schemes for mains extensions would be an advantage. Applications quoting ET and naming two referees on forms from District Manager, Seeboard, 42 York St, Twickenham, Middx, by 11 May, 1960.

SENIOR SALES REPRESENTATIVE
DORKING AND EPSOM DISTRICT

Salary: £640 x £20—£700 per annum under N.J.C. Grade 2. Superannuable. The person appointed will be required to give advice on supply matters, tariffs and appliance sales and installations for domestic and small commercial consumers. Applicants must be thoroughly conversant with all types of domestic electrical appliances and, in addition to acting as an outside representative, must be prepared to carry out general showroom duties in any showroom within the Dorking and Epsom district. Applications quoting ET and naming two referees on forms from District Manager, Seeboard, 56 South St, Dorking, by 11 May, 1960.

SHOWROOM ASSISTANT (MALE)
CROYDON AND PURLEY DISTRICT

Salary: £425 per annum at age 21, rising to £545 or £630 including London Allowance, according to age and qualifications. A knowledge of electrical apparatus and experience in dealing with consumers' enquiries will be an advantage, and cashier duties will be included. The person appointed must be prepared to work in any showroom in the Croydon and Purley district. Applications quoting ET and naming two referees to District Manager, Seeboard, Electric Hse, Wellesley Rd, Croydon, by 11 May, 1960.

GEORGE WRAY,
Secretary.
(P 722)

Advertisements should be sent to the Classified Advertisement Dept., Electrical Times, Sardinia House, Sardinia Street, London, W.C.2, before 10 a.m. on TUESDAY of the week of issue. Official Displayed Advertisements are charged at 40s. per inch, and all other classified advertisements at 3s. per line. Situations Wanted four insertions at twice the single insertion rate. Fee for Box Number and postage on replies 2s.

CITY & COUNTY OF BRISTOL EDUCATION COMMITTEE

Bristol Technical College

THE Governors invite applications for following posts in Engineering Department, to take effect from 1 September, 1960. Applicants should be suitably qualified, with industrial and/or teaching experience:

1. ASSISTANT (GRADE B) to teach Electrical Engineering to National Certificate courses and to Electrical Technicians (C. and G. course 57).

2. ASSISTANT (GRADE B) to teach Radio and Television Servicing to City and Guilds courses.

3. ASSISTANT (GRADE A or B) to teach Electrical Installation up to the B certificate of the City and Guilds.

Salaries: Burnham Technical Scale: Grade A, £520/£1,000 p.a.; Grade B, £700/£1,150 p.a. Placing on scales dependent on previous approved industrial or teaching experience. Additions to scales for graduate or equivalent qualification and training.

Details and application forms, returnable within 14 days of appearance of this advertisement, from Registrar, College of Technology, Ashley Down, Bristol 7. (P 694)

CENTRAL ELECTRICITY GENERATING BOARD

East Midlands Division

APPLICATIONS are invited for the following positions within the Division:

ASSISTANT SHIFT CHARGE ENGINEER
WILLINGTON "A" POWER STATION
VACANCY NO. 94/60

Applicants should have received a sound technical training and have had experience in a modern power station.

Preference will be given to candidates who possess the Higher National Certificate, or its equivalent.

Salary will be in accordance with Class I., Grade 8 (£1,195/£1,270 per annum) of the National Joint Board Agreement, plus 10% allowance for shift duties.

Closing date for receipt of applications, 13 May, 1960.

ASSISTANT SHIFT CHARGE ENGINEER
BURTON-ON-TRENT POWER STATION
VACANCY NO. 95/60

Applicants should possess H.N.C. or equivalent qualifications and have experience in power station operation.

Salary will be in accordance with Class E, Grade 9 (£765/£810 per annum) of the National Joint Board Agreement, plus £90 per annum shift allowance.

Closing date for receipt of applications, 13 May, 1960.

SENIOR DRAUGHTSMAN
(CIVIL ENGINEERING AND BUILDING)
TRANSMISSION DEPARTMENT,
DIVISIONAL HEADQUARTERS

Applicants for this appointment should have suitable technical training and be thoroughly conversant with the design and detailing for civil and building works, including steel and R.C. structures and foundations. The work is associated with H.V. substations and generating stations.

Salary will be in accordance with Grade 4 of Schedule D of the National Joint Board Agreement and will be within the range £930/£1,030 per annum.

Closing date for receipt of applications, 13 May, 1960.

These appointments will be pensionable within the terms and conditions of the Electricity Supply (Staff) Superannuation Scheme.

Applications should be submitted on the official form AE6/ACT which may be obtained from the Divisional Establishments Officer, Central Electricity Generating Board, East Midlands Division, P.O. Box 25, Barker Gate, Nottingham, and should be returned to the undersigned by the date stated.

O. S. WOODS,
Divisional Controller.

21 April, 1960.

(P 710)

THE BRITISH ELECTRICAL AND ALLIED MANUFACTURERS' ASSOCIATION

APPLICATIONS are invited for THREE POSTS OF ASSISTANT in the offices of the Association at Ascot, Berks. In each case candidates should have a good educational background, and first class experience in one of the three fields mentioned below.

Personality and administrative ability will also be looked for. The preferred age is 30/35.

The particular requirements of the posts are as follows:

Post 1: Experience with large electrical machines.

Post 2: Experience with control gear.

Post 3: A general working knowledge of switchgear and instruments.

A salary commensurate with qualifications and experience will be paid: there is a contributory Superannuation Fund.

Applications with full details of experience should be addressed to the Establishment's Officer, B.E.A.M.A., 36 Kingsway, London W.C.2. (P 700)

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

ASSISTANT CONSUMERS ENGINEER (2)

REQUIRED in the Liverpool Central District. Salary within range £710/£755 per annum (N.J.B. J/14).

Appointment subject to medical examination. Pension Scheme.

Duties include estimating and preparation of specifications for contracting work, advising consumers on matters relating to electricity supply and utilisation of electrical equipment.

The post offers an opportunity to a young man who has completed his electrical apprenticeship and made progress in his technical studies.

Standard application forms should be forwarded to the Manager, No. 1 Sub-Area, 24 Hatton Gdn, Liverpool 3, not later than 10 May, 1960. (P 712)

CENTRAL ELECTRICITY GENERATING BOARD

Eastern Division

APPLICATIONS are invited for the following appointments in the Divisional Electrical Department:

THIRD ASSISTANT ENGINEER
FINCHLEY (WEST) TECHNICAL SECTION
(S.V. NO. 1331)

Salary, N.J.B., Class AX/DX, Grade 6, £925 x £25—£1,050/£1,140 per annum plus London Weighting.

Previous experience in the commissioning of high voltage electrical apparatus and the maintenance of protective gear is essential.

Applicants should possess a Higher National Certificate in Electrical Engineering or its equivalent.

The applicant appointed will be required to reside in the Barnet-Watford-Harrow area.

FOURTH ASSISTANT ENGINEER
FINCHLEY (WEST) TECHNICAL SECTION
(S.V. NO. 1332)

Salary N.J.B., Class AX/DX, Grade 8, £735 x £25—£860/£935 per annum plus London Weighting.

Previous experience in the commissioning of high voltage electrical apparatus and associated protective gear would be an advantage.

Applicants should possess a Higher National Certificate in Electrical engineering or its equivalent.

The applicant appointed will be required to reside in the Barnet-Watford-Harrow area.

Applications, quoting the appropriate S.V. Number, stating age, qualifications, experience and present position should be sent to Controller, Central Electricity Generating Board, Eastern Division, West Farm Place, Chalk Lane, Cockfosters, Barnet, Herts., to arrive not later than 7 May, 1960.

(P 718)

THE NORTH WESTERN ELECTRICITY BOARD

FOURTH ASSISTANT ENGINEER
DESIGN SECTION
SUB-AREA ENGINEERING DEPARTMENT
MANCHESTER

APPLICANTS should have received a technical education to H.N.C. level, and preferably should have served an engineering apprenticeship or received equivalent training.

Duties include the preparation of schemes and estimates for extensions of a large city network and associated protective gear, together with work on re-equipping obsolete switchgear and high voltage substations.

Salary Scale: £910 x £15—£955 p.a. Grade M.13. N.J.B. Conditions.

Application Forms to be obtained from the Manager (Staff Vacancy), No. 1 Sub-Area, The North Western Electricity Board, Town Hall, Manchester, P.O. Box 493, and returned to him by 11 May, 1960.

NOTE: Applicants who responded to the previous advertisement of this post need not re-apply.

FOURTH ASSISTANT ENGINEERS
(RURAL DEVELOPMENT)
SUB-AREA ENGINEERING DEPARTMENT

Duties will be concerned with both engineering and commercial aspects of planning and preparation work for rural electrification.

Some experience of overhead line work and possession of the Higher National Certificate in Electrical Engineering will be advantageous.

The successful candidates will be based initially on Carlisle, Kendal or Workington but may be required to work in any part of the Sub-Area.

Salary Scale: £815 x £15—£860 p.a. Grade K.13. N.J.B. Conditions.

Application must be made on a form to be obtained from the Manager, No. 6 Sub-Area, The North Western Electricity Board, Castle Green, Kendal, and returned to him by 11 May, 1960. (P 703)

ADMINISTRATIVE COUNTY OF LEICESTER

ASSISTANT ELECTRICAL ENGINEER, £780/£1,070 according to qualifications. Candidates should be in possession of the Higher National Certificate in Electrical Engineering and be capable of preparing schemes for electrical installations in all types of buildings.

Lodging allowance and removal expenses may be paid to married men.

Apply to County Architect, 123 London Rd, Leicester. (P 625)

CENTRAL ELECTRICITY GENERATING BOARD

South Eastern Division

SYSTEM OPERATION DEPARTMENT,
EAST GRINSTEAD
VACANCY NO. 60A/60
FOURTH ASSISTANT ENGINEER

APPLICATIONS are invited for this appointment at the Thames South Grid Control Centre to assist in the department's planning works and possibly to undertake occasional shift duties in the Control Room. Experience of System Operation, power station or transmission practice required. Technical training to at least O.N.C. level required.

Salary N.J.B. Class AX/EX, Grade 8, £735/£960 per annum, with prospect of promotion to Grade 7, £840/£1,065 per annum when suitably experienced. Shift allowance will be payable when applicable.

Applications giving details of age, experience, qualifications, present salary, etc. should be sent to the Personnel Officer, Central Electricity Hse, Lower Ham Rd, Kingston upon Thames, Surrey, to arrive by 12 May, 1960.

W. H. DUNKLEY,
Divisional Controller.
(P 716)

Box No. replies to be addressed to the ELECTRICAL TIMES, Sardinia House, Sardinia Street, London, W.C.2

EASTERN ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments. The successful candidates will be required to contribute to a superannuation scheme and may be required to undergo a medical examination.

THIRD ASSISTANT ENGINEERS

(a) AYLESBURY DISTRICT
86/60.R.

(b) HERTFORD DISTRICT (Ref. 942)
87/60.R.

Candidates should have had a sound technical training and suitable experience in the construction, operation and maintenance of H.V. and L.V. distribution systems, including substations.

Salary: (a) N.J.B. Class F, Grade 9 (£815/£860); (b) N.J.B. Class G, Grade 9 (£860/£905).

Apply by letter as follows:

(a) F. Bent, M.I.E.E., A.M.I.MECH.E., Manager, Aylesbury District, Eastern Electricity Board, Exchange St, Aylesbury, Bucks, by 13 May, 1960.

(b) W. H. Hatton-Ward, ASSOCIATE I.E.E., A.M.B.I.M., Manager, Eastern Electricity Board, Bridgefoot, Ware, Herts, by 9 May, 1960.

Northmet Sub-Area

SUB-AREA CONSTRUCTION DEPARTMENT

FOURTH ASSISTANT ENGINEER (Ref. 947)
89/60.R.

Candidates should have had a sound technical training, be experienced in the supervision of underground cable laying by direct and contract labour and be capable of fault location, testing and commissioning.

Salary: N.J.B. Grade 12 (£1,075/£1,135 including London Allowance).

GENERAL ASSISTANT ENGINEER (Ref. 948)
88/60.R.

Candidates should have had a sound technical training and be experienced to assist in the supervision of direct or contract labour employed on cable laying and jointing of all classes of cable up to and including 33 kV.

Salary: N.J.B. Grade 14 (£960/£1,005 including London Allowance).

For these appointments apply by letter to the Manager, Northmet Sub-Area, Eastern Electricity Board, Northmet Hse, Southgate, London N.14, by 9 May, 1960. (P 739)

CENTRAL ELECTRICITY GENERATING BOARD

South Eastern Division

CROYDON "B" GENERATING STATION

VACANCY NO. 91/60

SHIFT CHARGE ENGINEER

APPLICANTS should have had considerable experience of operation of modern generating plant including P.F. boilers and should have technical training to H.N.C. standard.

Superannuation and sick pay schemes in operation.

Salary N.J.B. Class J, Grade 7, £1,254 10s/£1,337 per annum including London Allowance and 10% shift allowance.

Applications giving age, details of experience, etc. should be sent to the Personnel Officer, Central Electricity Hse, Lower Ham Rd, Kingston upon Thames, Surrey, to arrive by 12 May, 1960.

VACANCY NO. 92/60

ASSISTANT ENGINEER (EFFICIENCY)

CROYDON "B" GENERATING STATION

Applicants should have had experience of power station practice and should preferably hold at least O.N.C.

Superannuation and sick pay schemes in operation.

Salary N.J.B., Class J, Grade 14, £750/£795 per annum including London Allowance.

Applications giving age, details of experience, etc. should be sent to the Station Superintendent, Croydon "B" Generating Station, Beddington Farm La, Croydon, Surrey, to arrive by 12 May, 1960.

W. H. DUNKLEY,
Divisional Controller.
(P 717)

CENTRAL ELECTRICITY GENERATING BOARD

South Wales Division

APPLICATIONS invited for the following superannuable N.J.B. appointments:

STATION SHIFT CONTROL ENGINEER

LLANELLY POWER STATION

Vacancy No. 101/ET/60.

Salary: E.10, £710/£755 per annum, plus £90 shift enhancement.

Appropriate Engineering qualifications and a regular apprenticeship desirable, with operating experience in a generating station.

SHIFT CHARGE ENGINEER

CARDIFF POWER STATION

Vacancy No. 102/ET/60.

Salary: F.7, £910/£955 per annum, plus 10% shift enhancement.

Applicants should possess H.N.C. or equivalent and should have had operating experience in a generating station.

Special application forms obtainable from Secretary, South Wales Division, Central Electricity Generating Board, Twyn-y-fedwen Rd, Gabalfa, Cardiff, to be returned by 13 May, 1960. (P 741)

BAHRAIN STATE ELECTRICITY DEPARTMENT

TWO ELECTRICAL MAINTENANCE ENGINEERS REQUIRED

1. MAN between the ages of 30 and 45, with extensive practical experience of overhauling and maintaining power station electrical machinery up to 11 kV, including alternators, cables, 11 kV switchgear, auxiliaries and instruments.

Minimum qualification: H.N.C. in Electrical Engineering.

Salary: Grade K, Rs. 1,850/- rising to 2,100/- per month.

2. Man between the ages of 28 and 35, with power station experience with a bias towards instrument overhaul and circuit testing, must be prepared to do shift work for approximately the first 12 months.

Minimum qualification: H.N.C. in Electrical Engineering.

Salary: Grade M, Rs. 1,750/- rising to Rs. 2,100/- per month.

One Rupee = 1s 6d.

Joint duties which include the electrical maintenance of four 6·1 MW Brown Boveri Gas Turbine Generating Sets and 4·1 MW Dual Fuel Engine Driven Generating Sets, 11 kV switchgear and all associated auxiliaries.

Contract for two years in first instance. Kit and baggage allowance £60. Gratuity at rate of one month's salary for each year of service. Liberal leave on full salary. Free passages for officer, wife and two children under 18 years.

Write to the Crown Agents, 4 Millbank, London S.W.1. State age, name in block letters, qualifications and experience and quote M2A/50959/EE. (P 696)

CENTRAL ELECTRICITY GENERATING BOARD

Midlands Division

ASSISTANT ENGINEER (PLANNING)

HAMS HALL "A," "B" AND "C" POWER STATIONS

APPLICATIONS are invited from suitably qualified engineers for the above post.

The successful applicant will be responsible to the Planning and Efficiency Engineer and the duties would include the planning and progressing of station work, including boiler and turbine outages.

The appointment will be subject to N.J.B. service conditions and the salary will be in accordance with Grade M.6 (£1,470/£1,575) of Schedule A of the N.J.B. Agreement.

Apply quoting vacancy number 82/60MD on forms AE6 which are available from the Station Superintendent, Hams Hall Power Stations, Lea Marston, Sutton Coldfield, Warwickshire, to whom they should be returned when completed not later than 9 May, 1960.

F. W. SKELCHER,
Divisional Controller.
(P 723)

YORKSHIRE ELECTRICITY BOARD

No. 3 (Sheffield) Sub-Area

SHEFFIELD DISTRICT

ASSISTANT ENGINEER (CONTRACTING)

APPLICANTS should have had experience in estimating, tendering for and supervising electrical installation work and in preparing specifications, either with a Supply Authority or a firm of electrical contractors.

The successful candidate will be employed in the Electrical Installation Contracting Department.

Salary: N.J.B. Class L, Grade 11, £965 x £20—£1,025 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 3 (Sheffield) Sub-Area, Yorkshire Electricity Board, Commercial St, Sheffield 1, not later than 6 May, 1960.

No. 7 (Grimsby) Sub-Area

SCUNTHORPE DISTRICT

INSTALLATION INSPECTORS

Rate of pay, 5s 6½d per hour.

ELECTRICIANS

Rate of pay, 5s 1½d per hour.

JOINTER

Rate of pay, 4s 11½d per hour.

42-hour, five-day week. N.J.I.C. conditions of service. Rented housing accommodation may be available.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the District Manager, Yorkshire Electricity Board, 37 High St, Scunthorpe, not later than 13 May, 1960. (P 725)

SOUTHERN ELECTRICITY BOARD

ASSISTANT ENGINEER
(MAINTENANCE AND OPERATION)

ALDERSHOT District of No. 3 (Portsmouth) Sub-Area. Salary: N.J.B. Class G, Grade 11 (£765 x £15—£810 per annum). N.J.B. Conditions of Service.

The duties of the post will be to assist with the maintenance and operation of H.V. and L.V. distribution mains and substations and with minor construction work. A technical training to H.J.C. standard and experience of similar work are required.

Applications on forms obtainable from the Sub-Area, Lower Drayton La, Cosham, Portsmouth, and returned to him, quoting Z.1190, not later than 9 May, 1960.

ASSISTANT ENGINEER (LOCAL)

Swindon District of No. 2 (Newbury) Sub-Area, located at Cirencester. Salary: N.J.B. Class F, Grade 11 (£710 x £15—£755 per annum), with N.J.B. Conditions of Service, but present trends indicate that the District may be reclassified to Class G with effect from April 1, 1960.

Applicants should have experience in the design, construction, operation and maintenance of H.V. and L.V. overhead and underground distribution equipment, and possess suitable technical qualifications.

Applications on forms obtainable from the Sub-Area Secretary, 7 Oxford Rd, Newbury, Berks, and returned to him, quoting Z.1168, not later than 9 May, 1960.

GENERAL ASSISTANT ENGINEERS

Oxford District of No. 2 (Newbury) Sub-Area. Salary in each case N.J.B. Class J, Grade 16 (£610 x £15—£655 per annum, thence to £700 per annum maximum of Grade 15).

The duties of the posts will be to assist with distribution, including minor construction work and general maintenance of H.V. and L.V. overhead and underground distribution systems, substation plant, etc.

Applications on forms obtainable from the Sub-Area Secretary, 7 Oxford Rd, Newbury, Berks, and returned to him, quoting Z.1191, not later than 9 May, 1960.

The successful candidates for the above appointments will be required to contribute to the Electricity Supply (Staff) Superannuation Scheme, if eligible. (P 724)

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

ASSISTANT CONSUMERS' ENGINEER

REQUIRED to operate from Birkenhead in the North Wirral District. Salary £815/£860 per annum (N.J.B. H/11).

Applicants should preferably have had an engineering training and experience in dealing with installation work, consumers' supply enquiries and general commercial duties.

Appointment subject to medical examination. Pension Scheme.

Applications, on forms obtainable from the Manager, No. 3 Sub-Area, Electricity House, Newgate St, Chester, must be forwarded not later than 6th May, 1960.

(P 711)

BRITISH ENGINE BOILER & ELECTRICAL INSURANCE CO. LTD., Longridge Hse, Manchester 4. Electrical Surveyors required in England and Scotland. Permanent positions carrying progressive salary scale £800/£1,100 and non-contributory pension. Candidates aged 26 to 32, with H.N.C. in Electrical Engineering or Grad I.E.E. and with apprenticeship in manufacture or repair of electrical machinery, are invited to apply stating age, qualifications and experience.

(P 719)

CONSULTING ENGINEERS in Westminster require ASSISTANT ELECTRICAL ENGINEER, age about 25 to 30, with good training, first-class education and degree or Graduateship of I.E.E.—Box 7835, Electrical Times. (P 731)

SENIOR

DIELECTRICS RESEARCH ENGINEER

An experienced graduate Electrical Engineer or Physicist is required to lead a Dielectrics Research Group with the Brush Electrical Engineering Co. Ltd., which is a member of the Hawker Siddeley Group.

Applicants should be capable of organising, co-ordinating and supervising research projects which include environmental studies in insulation systems under very high temperatures and pressures, nuclear irradiation, chemically active atmospheres at high electrical stress, etc. Applicants should also have a good basic knowledge of dielectric theory, high voltage stress analysis and research techniques.

Applications, WHICH WILL BE TREATED IN THE STRICTEST CONFIDENCE, should give brief details of past experience and qualifications and should be addressed to the

Chief Personnel Officer,
Brush Electrical Engineering Company Limited,
Loughborough, Leics.

and should quote reference : PL.9056.

(P 701)

CONSULTING ENGINEERS require SENIOR and JUNIOR ELECTRICAL ENGINEERS for the design and supervision of electrical installations in all types of buildings. Good salaries and working conditions available to suitable applicants. Write giving full details to Box ET349, L.P.E., Romano Hse, 399/401 Strand, London W.C.2. (P 742)

ELECTRICAL ENGINEER INTERMEDIATE DRAUGHTSMAN with experience in the design of power and lighting installations for modern building projects are offered progressive careers. Five-day week and all mod. cons. Apply in confidence to: Pashler and Partners, Consulting Engineers, 73 Southampton Row, London W.C.1. (P 726)

ELECTRICAL ENGINEER FOR AUSTRALIA

An old established, and expanding, Australian electrical manufacturing organisation, with factories in the major States, requires an experienced rectifier engineer for its Semi-conductor Division. Headquarters of the organisation is in Sydney, New South Wales, with rectifier equipment manufacture centred in Melbourne, Victoria.

QUALIFICATIONS

(a) Applicants must have a degree or diploma in Electrical Engineering or have other qualifications that would exempt them from examinations leading to Associate Membership of the Institution of Electrical Engineers, London, and

(b) have had extensive experience as a professional engineer since obtaining the above qualifications in the design and construction of all types of rectifier and semi-conductor equipment, including saturable reactor control devices and magnetic amplifying equipment of the transistorised type, and

(c) be in the age group 30 to 40 years.

DUTIES

To take charge of the overall design, planning and production functions of the Companies' Semi-conductor Division. He will be responsible for a development programme and for the co-ordination and improvement of production. Promotion to management level is intended, and long-term career prospects are excellent.

SALARY AND CONDITIONS

Commencing salary will be £A2,500. Superannuation privileges are available with other fringe benefits.

APPLICATIONS

Applications, which will be treated in the strictest confidence, should be forwarded to W. A. Sparrow and Co. Ltd., 4/7 Chiswell St, London, E.C.1.

The Companies' Managing Director will be in London at an early date and will interview selected applicants. (P 714)

CENTRAL ELECTRICITY GENERATING BOARD

RESEARCH and DEVELOPMENT DEPARTMENT

APPLICATIONS BRANCH

60 MW EXPERIMENTAL DIRECT CURRENT PROJECT

A research project on **Direct Current Transmission** is about to be started which will provide a **unique opportunity for engineers and scientists** to gain experience in and contribute to a valuable new field of work.

The present position is that although Direct Current Transmission Systems have attractive technical and operational features they compare unfavourably from the points of view of flexibility, reliability and, except for certain applications, economics. It is these aspects which will be examined.

The Transmission Systems Section of the Applications Branch is, therefore, setting up an experimental 70 kV six-pulse direct current scheme of 63 MW in a laboratory at **Acton Lane "A" Generating Station, London N.W.10.** Initially the transmission scheme will be arranged with the rectifier and inverted ends 'back-to-back' for experimental work and then used as a practical transmission link at a major sub-station, in place of an existing alternating current tie.

ELECTRICAL AND ELECTRONIC ENGINEERS AND PHYSICISTS with either Honours Degrees or Higher National Certificates are required for the project team. Applicants should preferably have experience of either mercury-pool converters, or control systems, or the application of solid state devices, or high-voltage engineering. **Applications will also be welcome from recently qualified men and students who expect to graduate this year.**

Salaries on scales within one of the following ranges, according to duties and responsibilities: £1,590/£2,045 p.a., £1,245/£1,835 p.a. or, up to £1,350 p.a.

Applications concerning these appointments, which afford every prospect of advancement, should be made to the Personnel Officer, 24/30 Holborn, London E.C.1., stating age, qualifications, experience, present position and salary, by 9 May. Envelopes should be marked "Confidential". Ref ET/153.

(P 707)

NO FUTURE IN YOUR PRESENT POSITION?

WE are a medium-sized virile company with a forty-year reputation for electrical control equipment presenting unique opportunities to forward-looking men joining our Research, Development and Production teams. A new expansion programme calls for suitably qualified staff to exploit an interesting range of applications, from guided missile work to industrial automation. We offer secure, pensionable, progressive posts and the chance to BE SOMEBODY with a company quick to recognise and reward ability.

YOU are invited to apply for the following positions if you have the qualifications required coupled with a forceful outlook on today's technical problems and developments.

PHYSICIST
for the special study of semi-conductors and rotating mechanisms as applied to motor control equipment. Graduate or equivalent qualifications.

ELECTRONIC ENGINEERS
for the application of semi-conductors to Automation. H.N.C. or equivalent practical experience.

DESIGN ENGINEERS
PLANNING ENGINEERS
APPLICATION ENGINEERS
CONTRACTS ENGINEERS
CONTROL GEAR ENGINEERS
All the above are required for development of our motor control gear programme. Qualifications—H.N.C. or equivalent practical experience.

TIME AND MOTION STUDY ENGINEER
O.N.C. or equivalent.

ENGINEERING ESTIMATORS
O.N.C. or equivalent.

DETAIL DRAUGHTSMEN
DESIGN DRAUGHTSMEN
CIRCUIT DESIGN DRAUGHTSMEN
O.N.C. or equivalent practical experience.

Contact Mr. Bridle, Personnel Officer,
for full details in strictest confidence.

DEWHURST & Partner Limited,

Inverness Road, HOUNSLOW, Middx. **Tel. Hounslow 0083 (12 lines)**

(P 617)

DRAUGHTSMAN required for Consulting Engineers' Office, to assist in the design of lighting and power installations for all classes of buildings. Five-day week. Spring and summer holidays. Pension scheme and luncheon vouchers. Apply in writing, stating age, experience, present salary and salary required to J. Roger Preston and Partners, 15 North Audley St, W.1. (P 733)

ELECTRICAL ENGINEER required for Consulting Engineer's Office, to carry out the design of lighting and power installations for all classes of buildings. Five-day week. Spring and summer holidays. Pension scheme and luncheon vouchers. Apply in writing, stating age, experience, present salary and salary required, to J. Roger Preston and Partners, 15 North Audley St, W.1. (P 734)

ELECTRICAL ENGINEER required for Glasgow office staff, age 23-28. Applicants (H.N.C. minimum) should have had experience in the manufacture of electrical machines. Progressive salary with non-contributory pension. Applications stating age, nationality, qualifications and experience to British Engine Boiler & Electrical Insurance Co. Ltd., 98 West George St, Glasgow C.2. (P 720)

M.K. ELECTRIC LIMITED

require

SENIOR DESIGNER/DRAUGHTSMEN

for development work on electric wiring accessories and the like. Previous experience in this specialised field, together with a good knowledge of modern methods of quantity production, are essential. A substantial salary will be offered to suitable applicants. Applications in writing stating age, education and previous experience will be treated in strict confidence, and also acknowledged, if addressed to 'D.G.M.,' M.K. Electric Ltd., Shrubbery Rd, Edmonton, London N.9. (P 636)

UNITED KINGDOM
ATOMIC ENERGY AUTHORITY
require
ASSISTANT
ELECTRICAL ENGINEERS
AT CHAPELCROSS WORKS, ANNAN, DUMFRIESSHIRE

To be responsible to an Electrical Engineer for the commissioning and testing of new plant and the maintenance of existing plant in either:

(a) Nuclear Reactors comprising electrical auxiliary plant including large d.c. machines, operating on the Ward Leonard system, also specialised equipment and control circuitry.

(b) Conventional Power Station plant consisting of turbo-alternators and auxiliaries, H.V. distribution equipment and switchgear and associated protective devices.

Applicants must have served a recognised engineering apprenticeship and be Corporate Members of the I.E.E. or equivalent. Salary between £860 at age 25 and £1,340 per annum.

Contributory Superannuation. Staff Housing Scheme.

Send postcard to Personnel Manager at the above address for application form, quoting ref. G.35/J8.

CLOSING DATE: 16 MAY, 1960.

(P 699)

DOMESTIC APPLIANCE TESTING
E.D.A. TESTING HOUSE, LEATHERHEAD

To meet additional demands for the testing of domestic electrical appliances, for the British Electrical Approvals Board, for the British Standards Institution and for the Electricity Boards, applications are invited from those with experience in electrical testing who are desirous of obtaining a staff appointment in the Electrical Development Association's modern and well equipped laboratories at Leatherhead.

Salaries within the range of £570/£1,050 per annum, experience in the design of domestic appliances and H.N.C. or similar qualification being required for the higher salaries. Good conditions of service including a contributory pension scheme with free life insurance benefits, five-day working week, canteen facilities, etc.

Apply in writing giving details of age, qualifications and experience to the Director and Secretary, Electrical Development Association, 2 Savoy Hill, London W.C.2.

(P 702)

ELECTRICAL SUPERVISING ENGINEER required due to further expansion by large Contracting Organisation in Bristol. Applicant must be capable of handling Contracts up to £20,000 from receipt of order to final completion, including correspondence, supplementary estimates and buying. This is a permanent superannuated position offering considerable opportunity for advancement. A car will be provided for the successful applicant. Replies, which will be treated in confidence, should give details of experience, age and salary required to Box No. 7833, Electrical Times. (P 730)

LARGE London Electrical Engineering Contractors require SUPERVISING ENGINEER. Must be capable of handling projects from enquiry stage to final completion. Excellent prospects for right man. Permanent, superannuated position. Please write giving full details to Box No. 7827, Electrical Times. (P 704)

MANAGER for Electrical Wholesale Suppliers required. Salary commencing £1,000 p.a.—Box No. 7839, Electrical Times. (P 735)

TRAINEE SALES ENGINEERS
for posts
AT HOME AND ABROAD
required by
THE METER, RELAY AND INSTRUMENT DIVISION
THE ENGLISH ELECTRIC COMPANY LIMITED STAFFORD

The expansion of both the manufacturing and commercial activities of this division is to be accompanied by the appointment of a number of technical representatives.

Suitable young engineers, preferably with experience in power systems, metering, protection or instrumentation, will be appointed to overseas areas and United Kingdom territories after an introductory period. This will be settled on appointment and will vary between one and two years, depending on experience.

Applicants should have a Degree or Higher National Certificate in Electrical Engineering and should be between 27 and 40 years of age. They should possess a driving licence.

If you would like to visit Stafford to discuss these openings, please write giving full details to Dept. C.P.S., Marconi Hse, 336/7 Strand, London W.C.2, quoting reference ET 1297H. (P 697)

SWITCHBOARD ATTENDANT required for a large Industrial Power Plant situated in West London area. Experienced in synchronising turbo alternators and high tension switching essential. Four weekly shift cycles averaging 42 hours per week, weekly staff appointment. Please apply stating age, experience and wages required to Box No. 7829, Electrical Times. (P 705)

LIGHTING ENGINEER DRAUGHTSMAN

required by leading Lighting Fittings Manufacturer. Capable of preparing interior lighting designs, estimates, surveys, etc. Age 22/28. Salary dependent on age and experience. Write Box No. 7837, Electrical Times. (P 732)

TRANSFORMER DESIGNER for: transformers and L.F. Chokes. (a) Laminated and "C" core pattern up to 5 kVA; (b) Power Transformers up to 500 kVA. Salary according to age and experience. 5-day week. Contributory Pension Scheme. Apply: Willesden Transformer Co. Ltd., Manor Park Rd, N.W.10. ELGar 5445. (P 727)

TRANSFORMER REPRESENTATIVE for the Electronic and Industrial Transformer fields. Preference will be given to a person already engaged in a similar capacity. Salary plus commission. Car will be supplied.—Willesden Transformer Co. Ltd., Manor Park Rd, N.W.10. ELGar 5445. (P 728)

HEINZ
Leaders in the expanding Food Industry require an
ELECTRICAL DRAUGHTSMAN

to join their Head Office Engineering group in North West London. The work involves preparing control schemes and layouts for continuous processes and general installations; it covers a wide range of interests including the application of new techniques. Applicants should have had previous electrical experience in industry, preferably including work on control circuitry, and they should be qualified to H.N.C. level in electrical engineering.

Please give full details of experience to the Personnel Officer, H. J. Heinz Co. Ltd., Waxlow Rd, Harlesden, London N.W.10. (P 713)

TECHNICAL SALES REPRESENTATIVES

We require a number of ambitious young men to undergo a thorough training prior to being appointed to our technical sales force.

Applicants should be under 27 years of age, preferably single, possess H.N.C. and be willing to reside anywhere in the country. Experience of medium voltage electrical switchgear and distribution equipment preferred but not essential. The Company operates a pension fund for its employees.

Full details, in strict confidence, to:

The Sales Director,
DORMAN & SMITH LTD.,
Atherton Works, Blackpool Road,
PRESTON, LANCS.

(P 670)

THE British Lighting Council requires ENGINEER for development in lighting calling for imagination, personality, an ability to write technical copy and an aptitude for public speaking. Based on London, he will be expected from time to time to travel throughout the country. Degree or equivalent academic qualifications desirable.

Salary: £900/£1,300; contributory superannuation scheme. British Lighting Council, Brettenham Hse, 16-18 Lancaster Pl, London W.C.2. (P 698)

BUSINESSES FOR SALE

COMPLETE Rubber Covered Cable Manufacturing Business in the Midlands. Plant includes: Mixing Mills; Calendar; H.S. Braiding Machines; Longitudinal, Laying-up, Twinning and Stranding Machines; Vulcanizing Pans; Lead Press; Extruders; Machine Tools, etc. Or offers would be entertained for the Plant only as a unit. Further particulars of Henry Butcher and Co., 73 Chancery La, London W.C.2. Tel.: HOLborn 8411. (P 736)

ELECTRICAL wholesalers, some radio, medium size; London. Box No. 7831, Electrical Times. (P 706)

EDUCATIONAL

INDISPENSABLE TO WORKS MAINTENANCE ENGINEERS

ELECTRICAL FAULT DIAGNOSIS

A quick guide to trouble finding in all classes of industrial electrical equipment. Tables specially classified according to defects in plant giving causes of trouble and action required.

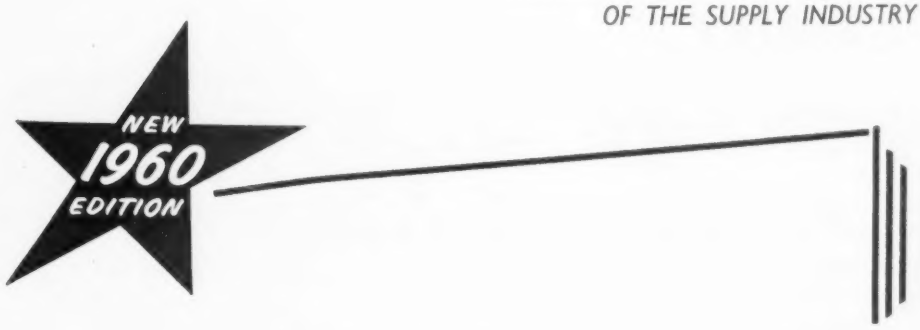
Tables cover a.c. motors, d.c. machines, a.c. generators, rotary converters, bearings, transformers, mercury arc rectifiers, starters and switchgear and fluorescent lighting.

Price **15/-** *Post Free*

Send order and remittance to Publishing Department, The Electrical Times Ltd. Sardinia House, Sardinia Street, London, W.C.2.

Classified Adverts Continued on Page 60

AUTHORITATIVE REFERENCE BOOK OF THE SUPPLY INDUSTRY



ELECTRICITY SUPPLY HANDBOOK 1960

Features
Organisational structure of supply industry

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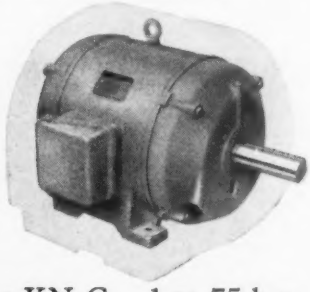

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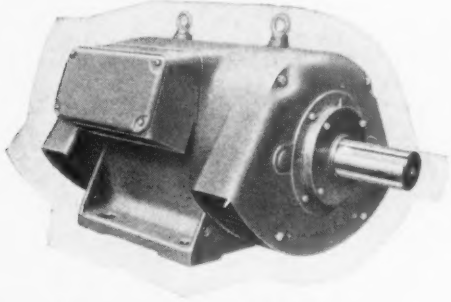

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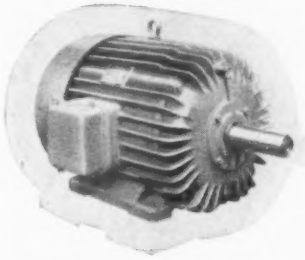

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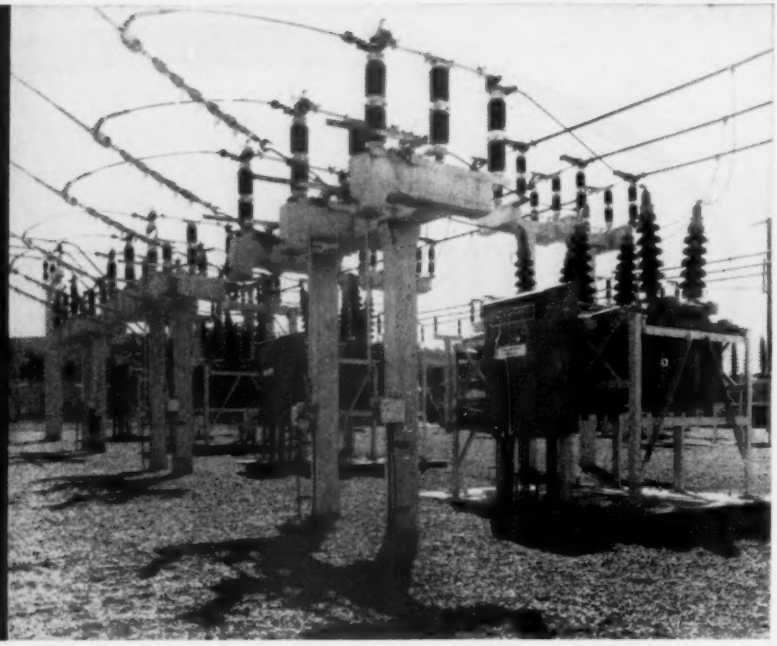

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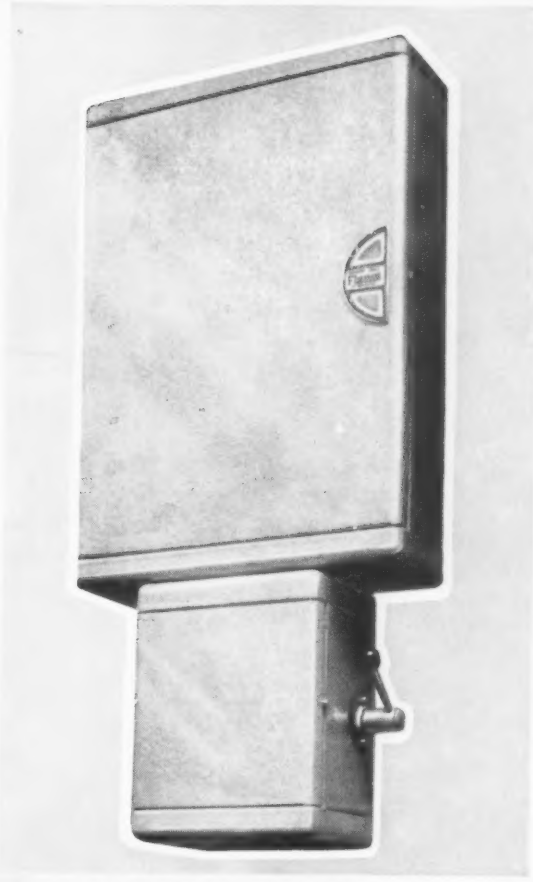

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